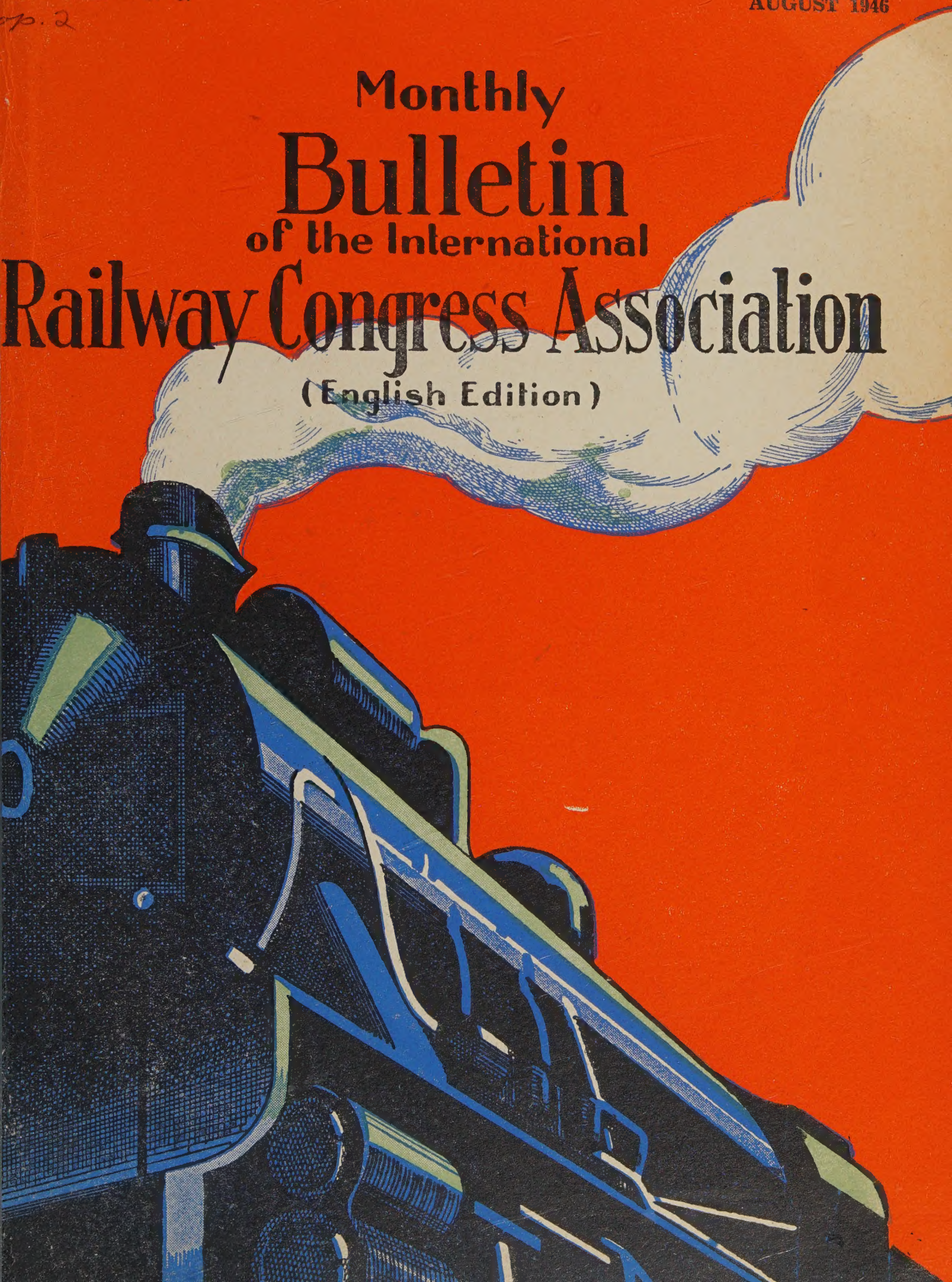
5606
NT
p. 2

OL. XXIII. — N° 5.

AUGUST 1946

Monthly Bulletin of the International Railway Congress Association

(English Edition)



S. A. LA BRUGEOISE et NICAISE & DELCUVE

Steel-works, Forges and Engineering Works

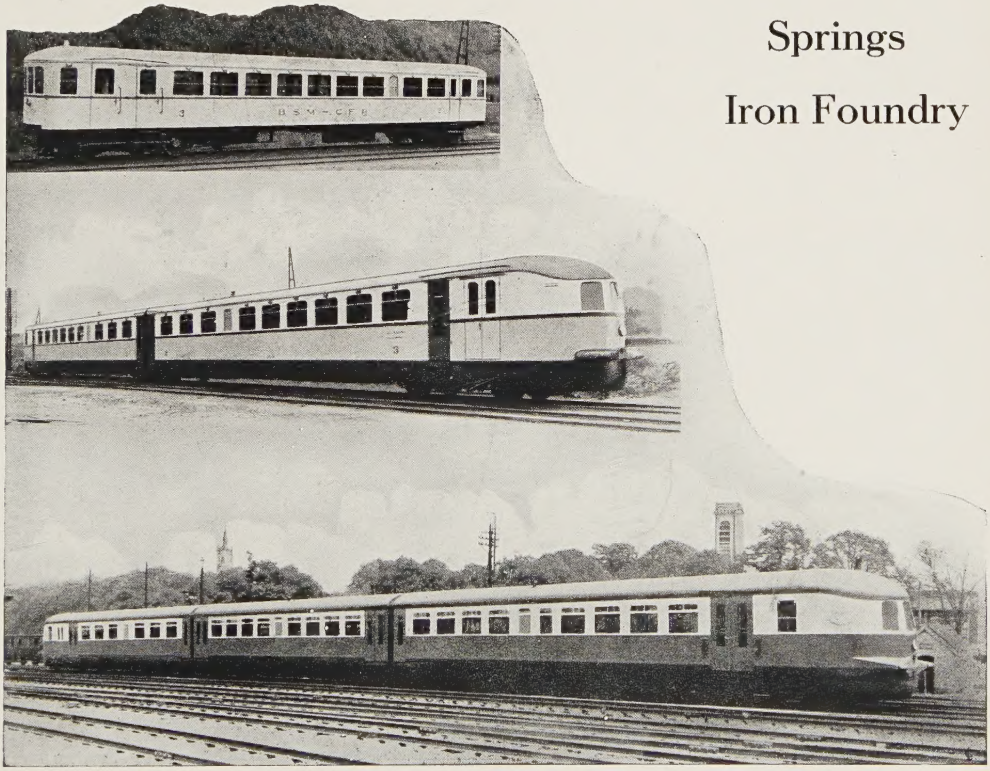
Works at St-Michel near Bruges and at La Louvière (Belgium)
General Management at St-Michel near Bruges

Rolling Stock and Fixed Equipment for Railways and Tramways

Bridges, Frames, Tanks
and all Metallic Constructions riveted and welded
Steel Castings of all kinds and qualities

Springs

Iron Foundry



AUTOMATIC SLACK-ADJUSTERS
MECHANICAL EMPTY-LOAD DEVICES

SAB

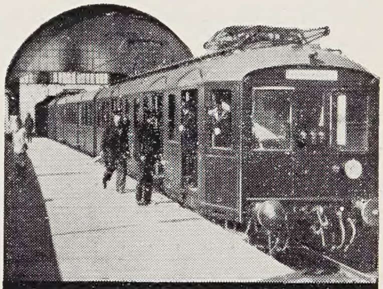
Svenska Aktiebolaget BROMSREGULATOR, Malmö - Sweden.

‘ENGLISH ELECTRIC’

TRACTION

Equipment

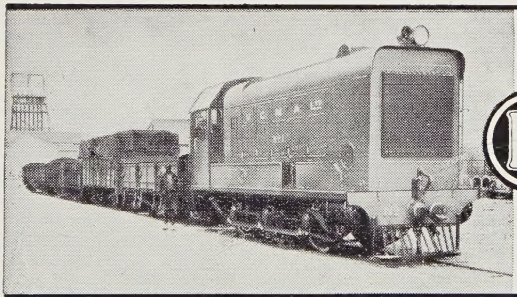
CANADA - 1925



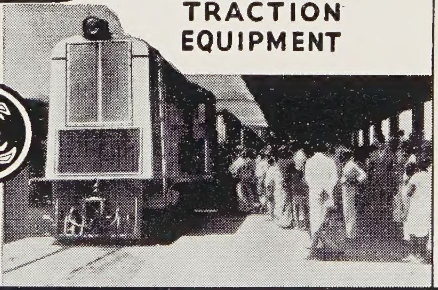
DENMARK - 1932

Installed all over the World

OVER
40 YEARS
EXPERIENCE
IS BEHIND
‘ENGLISH
ELECTRIC’
TRACTION
EQUIPMENT



SOUTH AFRICA - 1937



BRAZIL - 1938

The ENGLISH ELECTRIC Company Ltd
London Office: Queen's House · Kingsway · W.C.2

Works: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL

Alphabetical Index of Advertisers

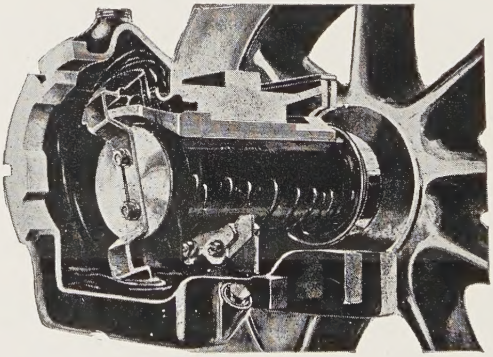
Firms :		Specialities :
Anglo-Franco-Belge des Ateliers de La Croyère, Seneffe et Godarville (Soc.)	—	Locomotives and Railway rolling stock.
Brown, Boveri & Co. Ltd.	—	Electric locomotives.
Brugeoise et Nicaise & Delcuve	II	Railway rolling stock and fixed equipment.
Cockerill (John)	—	Machinery and metal structures.
English Electric Company, Ltd (The)	IV	Railway electrification.
Isothermos (Société générale)	V	Axleboxes.
S. A. B. (Svenska Aktiebolaget Bromsregulator)	III	Automatic slack-adjusters.
S. K. F. (Société Belge des Roulements à Billes)	—	Axleboxes.
Usines Emile Henricot	—	Automatic couplers.

ISOTHERMOS

Axle box with mechanical lubrication

Bearing " Athermos "

Complete safety with any loads and at the highest speeds



Oil saving

No maintenance

Minimum coefficient of friction

Brussels - Société Générale " Isothermos " - Paris

9, rue du Moniteur

35, rue de la Tour d'Auvergne

Agents or Representatives in all main countries

In Great Britain : J. STONE & Co. Ltd. Oceanic House - 1a, Cockspur Street, London S.W.1

MONTHLY BULLETIN

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(ENGLISH EDITION)

THE LIBRARY OF T
SEP 23 1947
UNIVERSITY OF ILL

PUBLISHING and EDITORIAL OFFICES : 19, RUE DU BEAU SITE, BRUSSELS.

Yearly subscription for 1946 : (from April to December)

Belgium	**525 Belgian Francs**
Other countries	**600 Belgian Francs**

Price of this single copy : 80 Belgian Francs.

Subscriptions and orders for single copies (January 1931 and later editions) to be addressed to the General Secretary, International Railway Congress Association, 19, rue du Beau Site, Brussels (Belgium).

Orders for copies previous to January 1931 should be addressed to Messrs. Weissenbruch & Co. Ltd., Printers, 49, rue du Poinçon, Brussels.

Advertisements : All communications should be addressed to the Association, **19, rue du Beau Site, Brussels.**

CONTENTS OF THE NUMBER FOR AUGUST 1946.

CONTENTS

Page.

I. A **rail** renewal policy, by R. Campus 207
II. **Locomotive machine friction,** by Lawford H. Fry 222
III. **Oil-burning locomotives** of the G. W. R. 227
IV. Comparable **locomotive** ratings, by F. E. Wynne 231
V. **New York Central** develops **hot-box alarm** 235
VI. **Experience** with **VHF radio,** by L. J. Prendergast 241
VII. Obituary :
  Alfred **Mange** 24
  Charles **de Ruffi de Pontevès** 250
VIII. Official information issued by the Permanent Commission of the International Railway Congress Association :
  Meeting held by the Permanent Commission in Brussels, on 6th July 1946. 252
  Appendix I : **List of Members of the Permanent Commission** (July 6th, 1946). 256

CONTENTS *(continued)* Page.

Appendix II : **List of questions for discussion at the XIVth Session** (Lucerne, 1947) with the names of the Reporters 260

IX. New books and publications :

Evolution ascendante du contrat de transport au cours du XIX^e et du XX^e siècle (**The progressive development of the transport contract** during the XIXth and XXth centuries), by L. Josserand 263

Chemins de fer. — Agenda Dunod 1940 (Railways-Dunod Pocket Book 1940), by P. Place 264

X. Monthly bibliography 73

LIBRARY

OF THE

Permanent Commission of the International Railway Congress Association.

READING ROOM : **19, rue du Beau Site, Brussels.**

Works in connection with railway matters, which are presented to the Permanent Commission, are mentioned in the « Bulletin ». They are filed and placed in the library. If the Executive Committee deems it advisable they are made the subject of a special notice. Books and publications placed in the reading room may be consulted by any person in possession of an introduction delivered by a member of the Association. Books, etc., may not be taken away except by special permission of the Executive Committee.

The Permanent Commission of the Association is not responsible for the opinions expressed in the articles published in the Bulletin.

All original articles and papers published in the Bulletin are copyright, except with the consent of the Authors and the Committee.

An edition in French is also published.

VOL. XXIII. — No 5. August 1946.

BULLETIN
OF THE
INTERNATIONAL RAILWAY CONGRESS
ASSOCIATION
(ENGLISH EDITION)

[625. 173 (.493)]

A rail renewal policy,

by Mr. R. CAMPUS,
Honorary Chief Engineer of the Belgian National Railways,
Honorary Professor of the « Faculté polytechnique » of Mons.

I. — Rail wear.

The *vertical* wear on rails is, other things being equal, proportional to the traffic.

On curves we have in addition the *lateral* or side wear on the inside face of the head of the outer rail, wear which becomes more pronounced as the radius decreases and the fixed wheel-base of the rolling stock increases.

Mr. A. Jacops, First Engineer of the Belgian National Railways, has laid down in an article in the May 1940 issue of the *Bulletin of the International Railway Congress Association* the degree of inclination of the inside face of such outer rails beyond which danger of derailment is to be feared.

The fixing of automatic rail greasers at the entrance to curves has greatly reduced this side wear.

These devices, attached to the track, consist in principle of a grease reservoir or container which deposits a thin film of this substance on the inside face of the rail subject to the greatest wear, a little below the running surface. This grease deposit, the amount of which can be regulated, is brought about by the passage of the wheel tyres over a very small spring-loaded piston contained in the apparatus. The grease is spread along the curve by the wheel flanges.

Good results have also been obtained from employing, on curves of 500 m. (1.640 ft. 5 in.) or less radius, rails which have been subjected to heat treatment.

The percentage of such curves on the running lines of the Belgian National Railways is about 16 %. As most of these curves are found on lines of secondary importance, carrying no great amount of traffic, and the side wear affects only one of the two rails of a curve, the effect of these curves on the cost of renewals is of relatively small importance.

Rails laid in tunnels wear away, however, at a greater rate than those in the open, on account of the dampness existing there at all times and of the exhaust gases emitted by the locomotives.

This rapid wear is caused by the alteration in the metal at the rail surface, attacked by the acids in the surrounding atmosphere. The oxides of iron so created offer small resistance to wear, and are carried away as they form by the passing wheels, which in turn accelerates the process.

In addition, the other parts of the rail, in particular the foot and web, as well as the metallic fittings and fixtures with them, are subjected to a corrosion which increases with the dampness of the tunnel and with the degree to which its layout and direction offer obstacles to the free circulation of the air.

As only some 64 km. (about 40 miles) in round figures of main running lines are laid in tunnels out of a total length of 7 691 km. (4 780 miles) on the system, this cause of earlier than normal renewal has only a relatively small influence on the average renewal interval applying to to such lines.

II. — **Rail renewals.**

In principle it can be said that renewal is justified when maintenance costs begin to increase to a noticeable degree.

In fact a vertical wear on the rail head of 5 to 6 mm. (13/64 to 15/64 in.) is sufficient to warrant renewal.

When this degree of wear has been reached, the deformation of the rail ends and the wear where the fishplates have been bearing against them will be found to be such that maintenance becomes very expensive without being entirely satisfactory. Breakages occur more and more frequently, particularly at the rail ends, starting at the fishplates holes, which constitutes a serious source of danger, especially on high speed routes.

The Belgian National Railways adopted, as from 1933, a rail renewal policy based on the following considerations.

The result of numerous measurements taken on our main lines shows that the average vertical wear on the rail head is from 0.5 to 0.6 mm. (20 to 24/1 000 in.) annually, when the total weight of the trains traversing them dailly is of the order of 50 000 tonnes (49 210 Engl. tons).

It has been found, too, that this wear is not noticeably affected by gradients, whether rising or falling.

On falling gradients, the braking being normally effected with the wheels revolving, everything takes place between wheels and rails as if no brakes were being applied.

On a rising gradient, the additional load on the axles coming from the action of the driving mechanism and the effect of the inertia of the unbalanced masses is generally no greater than on the level or a falling gradient, the speed of the train and the evaporative capacity of the boiler being diminished.

III. — **The period of renewal.**

If we adopt the limit of wear of 5 to 6 mm. (13/64 to 15/64 in.) for rails in running lines, the period of renewal for a given section carrying 50 000 tonnes daily will be ten years.

Starting from this figure, the period of renewal « x » of a section carrying a daily traffic of « y » tons is given by :

$$x y = 500\,000$$

$$x = \frac{500\,000}{y} \quad (1)$$

This equation is that of an equilateral hyperbola referred to its asymptotes, which are perpendicular to one another.

The period of renewal on the high speed lines ($V \geqslant 120$ km. [75 miles] p.h.) has been reduced to 3/4 of that calculated under the formula (1), the practical vertical wear being thus brought down to about 4 mm. (5/32 in.). The more frequent renewal of rails on such lines, over which many high speed trains run, is justified for reasons of passenger comfort and safety.

The renewal period « x » of a section carrying a daily tonnage of « y » tonnes, is, under these conditions, given by :

$$x = \tfrac{3}{4} \times \frac{500\,000}{y} = \frac{375\,000}{y} \quad (2)$$

A distinction is made between :

- running lines, classed as A, or lines carrying express traffic on which $V\max \geqslant 120$ km. (75 miles) p.h.;
- running lines classed as B, on which 120 km. p.h. $> V\max. \geqslant 90$ km. (56 miles) p.h.; lines having a maximum speed equal to 90 km. p.h. are not included in this category unless the daily tonnage carried reaches 10 000 tonnes (9 842 Engl. tons);
- secondary lines, classed as A, on which 90 km. p.h. $\geqslant V\max. \geqslant 70$ km. (69 miles) p.h.

  Lines with a maximum speed equal to 70 km. p.h. are not included in this category unless the daily tonnage reaches 5 000 tonnes (4 921 Engl. tons);
- secondary lines classed as B, on which $V\max. < 70$ km. p.h.

IV. — Renewing with re-conditioned rails.

Rails taken out of express tracks and B class main lines are sorted at the Schaerbeek shops; those capable of being made fit for use again in secondary lines are classified in piles of equal vertical wear, 3, 4, 5 mm. (1/8 in., 5/32 in., 13/64 in.) etc. After cropping the battered ends and those having worn fishing surfaces, straightening and, when necessary chamfering the sloping faces of the rail head, lengths of 50 kgr./m. (100.8 lb. per yard) rail carrying equal wear are buttwelded electrically to form 35 m. (115 ft.) rails, perfectly jointed (¹).

These rails are used in renewing secondary lines carrying a daily traffic not reaching a figure of 5 000 tonnes (4 921 Engl. tons). For a volume of traffic of this order, the annual wear is :

$$\frac{0.5 \times 5\,000}{50\,000} = 0.05 \text{ mm. to } \frac{0.6 \times 5\,000}{50\,000}$$

$= 0.06$ mm. (13/64 in. to 15/64 in.).

Rails the vertical wear on which amounts to 4 to 5 mm. (10/64 to 13/64 in.) can thus be laid in lines carrying such traffic and can be kept in service there for 20 to 25 years, until the wear reaches or slightly exceeds 6 mm. (15/64 in.), that is for the average time a new sleeper lasts in a running line.

It is to be observed that these re-conditioned rails worn by 4 mm. having supported a traffic of at least

$$\frac{50\,000 \times 360}{0.6} \times 4 = 120\,000\,000 \text{ T.}$$

(118 104 600 Engl. tons), without any defect appearing in the metal, may be regarded as being excellent ones.

(¹) The Railway Rail Joint by R. CAMPUS (*L'Ossature Métallique*, monthly journal dealing with the applications of steel, published by the Belgo-Luxembourg Steel Information Centre. September-October 1945).

No disadvantage would in fact arise from laying in B class secondary lines where the daily traffic does not exceed 2 000 tonnes (1 968 Engl. tons), reconditioned rails carrying a vertical wear of 6 mm., should there be a shortage of those of the 5 mm. class.

V. — Calculation of the percentage of new rails needed annually for the renewal of main running lines.

If p is the period of renewal of a section of line L between two junctions and consequently subject to a known amount of traffic, the mean figure for a group of sections, for each of which the period of renewal is different, is :

$$p_m = \frac{\Sigma L}{\Sigma \frac{L}{p}}$$

The density of traffic on all sections on the entire system included between junctions is every year made the object of a statistical enquiry.

The last enquiry was done for 1938, no other having been made since, as the world war broke out in 1939.

The average age of rails on a section is given by

$$a_m = \frac{\Sigma al}{\Sigma l},$$

l being the total length of rails of the same age a.

The *index* or key number of a section is the relation between the average age of its rails and its period of renewal.

$$i = \frac{a_m}{p}$$

For one particular section this index can come near to being 0, if the whole of the rails thereon have just been renewed, or be equal to 1 if they have attained the practical age limit, or can have any value between 0 and 1. If it is greater than 1, then the limit has been exceeded.

Under a rational system of organisation, the average age of a group of lines should be at least equal to half the mean period of renewal applying to them, that is to say that the average index figure should be :

$$i_m \leqslant 0.5$$

It is possible to determine the periodic renewal index of various lines and categories of lines of a given group or permanent way district, as well as the general index applying to the group.

In like manner it is possible to arrive at a renewal index for each category of lines in the whole system as well as one for the system itself.

These figures give the key to the situation on the system and its administrative subdivisions.

The accompanying tables give the situation as regards renewals with new rails in running lines after the enquiry and the renewals effected in 1938. They also give the extent of secondary lines capable of being renewed by means of reconditioned rails, the daily tonnage not exceeding 5 000 tonnes (4 921 Engl. tons) per track.

The tables referring to the Antwerp group of lines, the first to come alphabetically, are the only ones reproduced in full. This group is also the one containing the greatest proportion of lines carrying a heavy traffic. The tables referring to the other groups give the position as it covers the whole of each category of lines whithin the group, and the percentage of new rails needed annually for renewals in each of the groups.

Finally, the final tables give the situation of the whole of each category of lines on the system and the annual percentages for renewals with new rails, with respect to the total mileage of track to be so renewed and the total track mileage of the system.

The percentage of renewals with new rails is of the order of 2.72 % of the total mileage of running lines.

The particulars given in these tables have a relative character only, for the nature and density of the traffic on each particular line are always varying, more or less, from one year to another. But, such as they are, they provide us with information sufficiently exact to serve as a basis for a rational policy of running line renewals.

During the last three months in each year the groups submit to the head offices their rail renewal proposals. These are examined by the permanent way department there, in the light of the information given by the tables covering the situation on the various lines and the visits made on the ground, in the course of which the condition of the rails and the amount of wear on the head are examined.

The determination of the wear on the head is effected by means of a calliper and a gauge (Plate 1). A scraper is used to clear away rust from the fishing surfaces and the web of the rails where the calliper is applied.

The general running line rail renewal programme, using new or reconditioned rails, is drawn up on the basis of these visits.

Apart from the rails in running lines calling for renewal by reason of pro-

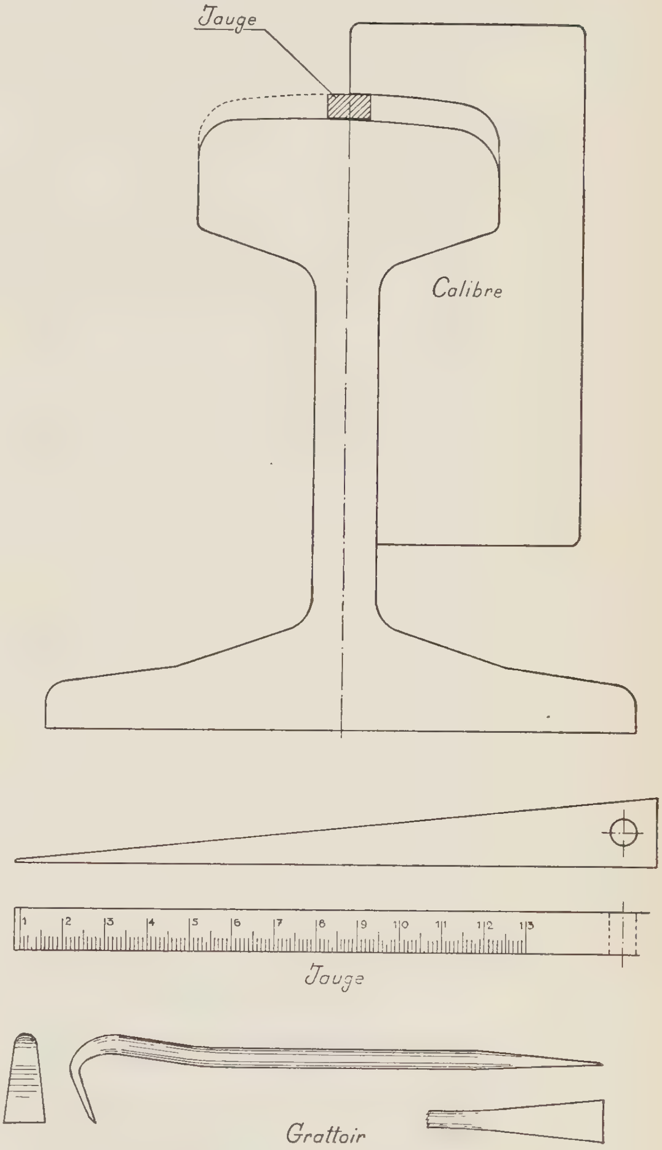


PLATE 1.

Explanation of French terms:
Jauge = gauge. — Calibre = calliper. — Grattoir = scraper.

nounced wear, there are others that are renewed before the normal time when station layouts are being rearranged or the alignment of lines is being improved, the logical course to take, as it makes for uniform and well-built installations, resulting in reduced working and maintenance costs.

The materials recovered in the course of renewals and modifications are sent to the central permanent way department depot, where they are classified according to their degree of wear and are repaired.

This reconditioning of materials enables supplies of uniform quality to be made available to the staff responsible for carrying work out, the quality being in relation to the particular work in view, so that, in the last analysis, the best use is made of all the rails under the most rational conditions.

The mileage of running lines on the system appearing in the last table on page 221 does not included those cases where the tracks through a station are doubled.

If the percentage figure of 2.72 is applied to the total length involved, doubled tracks in stations included, or to some 7 691 km. (4 780 miles), we get for the average number of kilometres to be renewed annually with new rails :

$$\frac{7\,691 \times 2.72}{100} = 209.195 \text{ km.,}$$

or in round figures, 210 km. (130 miles).

When the renewal programme for 1938 had been completed, the average age of the rails in running and secondary lines, carrying a daily traffic per track of at least 5 000 tonnes, lines on which the renewals are effected with new rails, was 11.5 years, that is to say 3.5 years less than half the average period of renewal applying to those lines.

This is to be attributed in great measure to the fact that immediately after the 1914-1918 war, secondary lines carrying light traffic were relaid with new material, and rails which were not heavy enough for high speed lines carrying a heavy traffic were renewed before the normal time, and to a lesser degree to the absence of any rational policy covering rail renewals prior to 1933, the good effects of which can only be felt by degrees, at more or less lengthy intervals.

In the course of the seven years 1939 to 1945 inclusive, rails were renewed on 190 km. (118 miles) only of running lines, that is approximately the amount of a single normal year. So that instead of being 3.5 years ahead, we are 2.5 years behind.

The rails have therefore been insufficiently renewed to the extent of 210 × 2.5 or 525 km. (326 miles), which corresponds to 52 500 tonnes (51 570 Engl. tons) of the standard pattern. The trouble is particularly great on lines carrying fast traffic and having a short renewal period, where large numbers of trains run daily, the total loading per track being of the order of 40 000 to 50 000 tonnes (39 000 to 49 000 Engl. tons).

The adoption of the one single type of rail, weighing 50 kgr. (100.8 lb per yard) per meter for all new work in running lines, the provision of transitions, lengths adapted to the superelevation and the speed of the trains, between straight track and circular curves and between circular curves of different radius, the improvements made to the rail joints and the reform in maintenance methods, have noticeably reduced the harmful effects of the traffic on the rails. It would not be unreasonable therefore, in the light of what has been stated above, to defer rail renewals for a little while, particularly on lines of light traffic.

We are limited in doing this, however, by the need of having at our disposal rails fit for re-use to serve as replacements on secondary lines where the daily traffic per track does not amount to 5 000 tonnes (4 921 Engl. tons), and for making up re-usable points and crossings in such rails at the Bascoup Works as well as for replacing damaged rails in running lines, whether in the normal course of maintenance or for accidental reasons, and for the fitting up at Schaerbeek depot of complicated points and crossing layouts made with such rails for use on secondary lines, in station approaches and yards, and for renewals on station tracks.

Past experience enables us to determine the amounts needed to cover these requirements, as follows :

1. For renewal in secondary lines (50 km. [31 miles] of track)	100 km.
2. For the construction and fitting up of re-usable points and crossings, at Bascoup Works	100 km.
3. Regular maintenance and accidental causes	60 km.
4. For fitting up re-usable points and crossings at Schaerbeek depot	20 km.
5. For replacements in sidings and similar lines	120 km.
Total length of rails needed	400 km.

These requirements leave no margin and are even considerably above our resources, if we take account of the waste arising from cropping the damaged ends of rails for the length of the fishing surfaces and scrap, which can be taken as being some 10 %. It thus regularly happens that the renewal of rails in sidings and similar lines, the total length of which comes to some 5 800 km. (3 600 miles) cannot be carried out completely, in spite of the balance of rails made available by employing re-conditioned rails on the secondary lines.

TABLES.

Renewal of rails.

ANTWERP group.

New rails.

No. of lines.	*Main lines A.* Vmax. $\geqslant$ 120 km./p.h.	Length in km. l	Tonnage per track.	Period of renewal. p	$\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m\,l$.
12	Antwerp — Austruweel . . .	18.700	25000	15	1.247	6.10	0.41	114.070
	Austruweel — Esschen . . .	47.800	9200	41	1.166	5.29	0.13	252.862
25A	Weerde — Bif. Wilrijck . .	49.900	13650	27	1.847	10.82	0.40	539.918
25E	Brussels — Antwerp	87.700	17800	21	4.176	2.52	0.12	221.004
25S	Brussels N. — Schaerbeek . .	5.700	31500	12	0.475	5.32	0.44	30.329
	Schaerbeek — Vilvorde . . .	14.800	29450	13	1.134	2.59	0.20	38.332
	Vilvorde — Malines	22.300	27350	14	1.593	4.34	0.31	96.782
	Malines — Bloc 19 S . . .	36.800	19400	19	1.937	6.77	0.36	249.136
	Bloc 19 S — Berchem . . .	8.500	49600	8	1.062	6.90	0.86	58.650
	Berchem — Antwerp C. . . .	4.000	32050	12	0.333	8.00	0.67	32.000
	Berchem — Antwerp E. . . .	2.300	19900	19	0.121	12.40	0.65	28.520
36	Schaerbeek — Louvain . . .	53.200	32300	12	4 433	2.76	0.23	146.832
	Louvain — Tirlemont . . .	37.200	34750	11	3.382	1.09	0.1	40.548
	Tirlemont — limit of group .	45.000	44050	9	5	3.28	0.36	147.600
50	Brussels N. — Laeken . . .	4.800	40250	9	0.533	5.28	0.59	25.344
	Laeken — Jette	7.600	20700	18	0.422	7.05	0.39	53 580
53	Malines — Louvain	48.200	31100	12	4.017	6.17	0.51	297.394
	Termonde — Londerzeel O. .	26.000	15850	24	1.083	6.70	0.28	174.200
	Londerzeel O. — Malines . .	26.200	12600	30	0.873	5.75	0.19	150.650
91	Circle line of Brussels . . .	16.000	21750	17	0.941	1.01	0.06	16.160
		562.700		15.727	35.775	4.82	0.31	2713.911
	Main lines B. 120 km./p.h. > Vmax $\geqslant$ 90 km./p.h. — When Vmax = 90 km./p.h., it must be T $\geqslant$ 10 000 t. per track.							
15	Antwerp — Lierre	28.300	26400	19	1 489	6.47	0.34	183.101
16	Lierre — Aerschot	48.950	14250	35	1.399	10.04	0.29	491.458
34	Aerschot — Louvain	30.800	20600	24	1.283	12.19	0.51	375.452
	To carry forward . . .	108.050			4.171			1050.011

Antwerp group.

o. f es.	*Main lines B.*	Length in km. l	Tonnage per track.	Period of renewal. p	$\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m\, l.$
	Brougt forward . . .	108.050			4.171			1050.011
2A	Antwerp S. — Luithagen . .	30.000	20550	24	1.250	19.85	0.83	595.500
0	Jette — Termonde	52.500	8150	61	0 861	4.94	0.08	259.350
9	Louvain — Weert-St.-Georges.	24.200	19450	26	0.931	13.11	0.50	317.262
1	Schaerbeek — Hal	53.800	14700	34	1.582	8.18	0.24	440.084
		268.550		30.534	8.795	9.91	0.32	2662.207
	Secondary lines A. 90 km./p.h. $\geqslant$ Vmax $\geqslant$ 70 km./p.h. When Vmax = 70 km./p.h., it must be T $\geqslant$ 5 000 t. per track.							
5	Lierre — Herenthals	40.800	6850	73	0.559	24.15	0.33	985.320
9	Aarschot — Weelde	50.200	6500	77	0.652	14.90	0.19	747.980
2	Termonde — Boom	40.300	8500	59	0.683	16.75	0.28	675.065
	Boom-Bif. — Kontich K. . .	22.500	5450	91	0.247	9.14	0.10	205.650
1	Boom-Bif. — Hoboken . . .	21.000	5700	88	0.239	19.02	0.22	399.420
	Londerzeel — Boom	9.500	5000	100	0.095	30.23	0.30	287.185
		184.300		74.465	2.475	17.91	0.24	3300.620
	Secondary lines B. Vmax. $\leqslant$ 70 km./p.h.							
5	Kontich — Lierre	7.500	6600	76	0.099	26.45	0.35	198.375

Renewal with re-conditioned rails on secondary lines where the daily tonnage is less than 5 000 tons per track.

No. of lines.	*Secondary lines B.*	Length in km.	Tonnage per track.	
61	Allée Verte — Brussels N. .	3.100	3750	
	Opwijk — Londerzeel O. . .	12.100	1400	
		15.200		

For the whole of the lines of the Antwerp group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. am	Index. $i = \frac{am}{p}$	$am\ l$.
A. *New rails.*						
Main lines A.	562.700	15.727	35.775	4.82	0.31	2713.911
Main lines B.	268.550	30.534	8.795	9.91	0.32	2662.207
Secondary lines A. . . .	184.300	74.465	2.475	17.91	0.24	3300.620
Secondary lines B. . . .	7.500	76.000	0.099	26.45	0.35	198.375
	1023.050	21.698	47.144	8.68	0.40	8875.113
B. *Re-conditioned rails.*	15.200					
	1038.250					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails :

$$\frac{47.144}{1023.050} = 4.61\ \%.$$

2. In relation to the total mileage of the lines belonging to the group :

$$\frac{47.144}{1038.250} = 4.54\ \%.$$

For the whole of the lines of the Charleroi group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. am	Index. $i = \frac{am}{p}$	$am\,l$.
A. *New rails.*						
Main lines A.	108.400	14.240	7.6125	7.56	0 53	820.332
Main lines B.	259 800	33.389	7.781	6.80	0.203	1766.461
Secondary lines A. . . .	205.700	64.777	3.1755	12.51	0.19	2573 209
Secondary lines B. . . .	5.100	89.000	0.057	27.92	0.31	142.392
	579 000	31.086	18.6260	9.16	0.29	5302.394
B. *Re-conditioned rails.*	248.200					
	827.200					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{18.626}{579} = 3.22\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{18.626}{827.200} = 2.25\ \%$.

For the whole of the lines of the Ghent group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. am	Index. $i = \frac{am}{p}$	$am\,l$.
A. *New rails.*						
Main lines A.	641.900	20.539	31.253	7.44	0.36	4776.665
Main lines B.	337.300	54.953	6.138	12.95	0.23	4368.190
Secondary lines A. . . .	371.600	56 315	6.588	19.71	0.35	7326 085
Secondary lines B. . . .	14.400	51.521	0.2795	11.23	0.22	161.752
	1365.200	30.841	44.2585	12.18	0 39	16632.692
B. *Re-conditioned rails.*	315.800					
	1681.000					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{44.2585}{1365.200} = 3.24\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{44.2585}{1681.000} = 2.63\ \%$.

For the whole of the lines of the Hasselt group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m l$.
A. *New rails.*						
Main lines B.	196.300	31 327	6.266	11.16	0.36	2190.028
Secondary lines A. . . .	243.500	90.840	2.683	25.88	0.28	6302.740
Secondary lines B. . . .	14.900	56.015	0.266	26.65	0.48	397.124
	454.700	49.342	9.215	19.6	0.40	8889.892
B. *Re-conditioned rails.*	109.000					
	563.700					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{9.215}{454.700} = 2.03\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{9.215}{563.700} = 1.63\ \%$.

For the whole of the lines of the Liége group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m l$.
A. *New rails.*						
Main lines A.	66.400	11.905	5.556	4.14	0.35	274.727
Main lines B.	369.200	29.336	12.585	9.35	0.32	3454.535
Secondary lines B. . . .	312.900	63.008	4.966	14.45	0.23	4521.476
	748.500	32.393	23.107	11.02	0.34	8250.738
B. *Re-conditioned rails.*	216.400					
	964.900					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{23.107}{748.500} = 3.09\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{23.107}{964.900} = 2.39\ \%$.

For the whole of the lines of the Mons group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. am	Index. $i = \frac{am}{p}$	$am\ l$.
A. *New rails.*						
Main lines A.	318.100	23.908	13.305	10.34	0.43	3300.328
Main lines B.	290.300	35.576	8.160	10.25	0.29	2975.180
Secondary lines A. . . .	260.300	68.554	3.797	17.71	0.26	4609.802
	868.700	34.387	25.262	12 53	0.36	10885.310
B. *Re-conditioned rails.*	185.500					
	1054 200					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{25.262}{868.700} = 2.90\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{25.262}{1054.200} = 2.40\ \%$.

For the whole of the lines of the Namur group.

	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. am	Index. $i = \frac{am}{p}$	$am\ l$.
A. *New rails.*						
Main lines A.	411.800	29.168	14.118	7.31	0.25	3008.691
Main lines B.	339.000	26.888	12.608	10.42	0.39	3532.502
Secondary lines A. . . .	180.800	64.780	2 791	19.31	0.30	3490.909
	931.600	31.561	29.517	10.77	0.34	10032.102
B. *Re-conditioned rails.*	193.500					
	1125.100					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{29.517}{931.600} = 3.17\ \%$.

2. In relation to the total mileage of the lines belonging to the group : $\frac{29.517}{1125.100} = 2.62\ \%$.

SYSTEM.

New rails.

Main lines A.	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. a_m	Index. $i=\frac{a_m}{p}$	$a_m l$
Antwerp group	562.700	15.727	35.775	4.82	0.31	2713.911
Charleroi group	108.400	14.240	7.6125	7.56	0.53	820.332
Ghent group	641.900	20.539	31.253	7.44	0.36	4776.665
Hasselt group	—	—	—	—	—	—
Liége group	66.400	11.905	5.556	4.14	0.35	274.727
Mons group	318.100	23.908	13.305	10.34	0.43	3300.328
Namur group	411.800	29.168	14.118	7.31	0.25	3008.691
	2109.300	19.599	107.6195	7.06	0.36	14894.654
Main lines B.						
Antwerp group	268.550	30.534	8.795	9.91	0.32	2662.207
Charleroi group	259.800	33.389	7.781	6.80	0.23	1766.461
Ghent group	337.300	54.953	6.138	12 95	0.23	4368.190
Hasselt group	196.300	31.327	6.266	11.16	0.36	2190.028
Liége group	369.200	29.336	12.585	9.35	0.32	3454.535
Mons group	290.300	35.576	8.160	10.25	0.29	2975.180
Namur group	339.000	26.888	12.608	10.42	0.39	3532.502
	2060.450	33.056	62.333	10.16	0.31	20949.103
Secondary lines A.						
Antwerp group	184.300	74.465	2.475	17.91	0.24	3300.620
Charleroi group	205.700	64.777	3.1755	12.51	0.19	2573.209
Ghent group	371.600	56.315	6.588	19.71	0.35	7326.085
Hasselt group	243.500	90.840	2.683	25.88	0.28	6302.740
Liége group	—	—	—	—	—	—
Mons group	260 300	68.554	3.797	17.71	0.26	4609.802
Namur group	180.800	64.780	2.791	19.31	0.30	3490.909
	1446.200	67.235	21.5095	19.09	0.28	27603.365

Secondary lines B.	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m\, l$
Antwerp group	7.500	76	0.099	26.45	0.35	198.375
Charleroi group	5.100	89	0.057	27.92	0.31	142.392
Ghent group	14.400	51.521	0.2795	11.23	0.22	161.752
Hasselt group	14.900	56.015	0.266	26.65	0.48	397.124
Liége group	312.900	63.008	4.966	14.45	0.23	4521.476
Mons group	—	—	—	—	—	—
Namur group	—	—	—	—	—	—
	354.800	62.603	5.6675	15.28	0.24	5421.119

Renewal with re-conditioned rails on secondary lines where the daily tonnage is less than 5 000 tons per track.

	Length in km. l
Antwerp group	15.200
Charleroi group	248.200
Ghent group	315.800
Hasselt group	109.000
Liége group	216.400
Mons group	185.500
Namur group	193.500
	1283.600

SYSTEM	Length in km. l	Period of renewal. p	Length to be renewed annually. $\frac{l}{p}$	Average age. a_m	Index. $i = \frac{a_m}{p}$	$a_m\, l$
A. *New rails.*						
Main lines A.	2109.300	19.599	107.6195	7.06	0.36	14894.654
Main lines B.	2060.450	33.056	62.333	10.16	0.30	20949.103
Secondary lines A.	1446.200	67.235	21.5095	19.09	0.28	27603.325
Secondary lines B.	354.800	62.603	5.6675	15.28	0.24	5421.119
	5970.750	30.288	197.1295	11.53	0.38	68868.201
B. *Re-conditioned rails.*	1283.600					
	7254.350					

Annual renewal percentage with new rails.

1. In relation to the mileage of the lines to be renewed with new rails : $\frac{197.1295}{5970.750} = 3.30\ \%.$

2. In relation to the total mileage of the lines belonging to the system : $\frac{197.1295}{7254.350} = 2.72\ \%.$

[621. 131. 1]

Locomotive machine friction,

by **Lawford H. Fry,**
Railway Engineer, Edgewater Steel Company, Pittsburgh, Pa.

(Railway Mechanical Engineer.)

The purpose of this article is to obtain a general expression for the machine friction of a steam locomotive. The experimental data is taken from locomotive testing-plant reports for the eleven locomotives listed in Table 1. The data is from tests made on the plants at Purdue, at the University of Illinois and at the Altoona plant of the Pennsylvania. A wide variety of designs and sizes are covered, ranging from Goss's 4-4-0 type locomotive with 61 000 lb. on drivers to the Pennsylvania Class IIs, 2-10-0 type with 342 000 lb. on drivers. Friction values for over 375 individual test runs have been plotted.

From this mass of experimental data it is concluded that the machine friction is related to the number of coupled axles, the total weight on drivers and the driving-wheel diameter by the equation

$$F = \frac{0.33\ n.W}{D} \quad . \quad . \quad . \quad . \quad . \qquad (1)$$

Where

n = the number of driving axles coupled in a group.

W = the weight on all driving wheels in pounds.

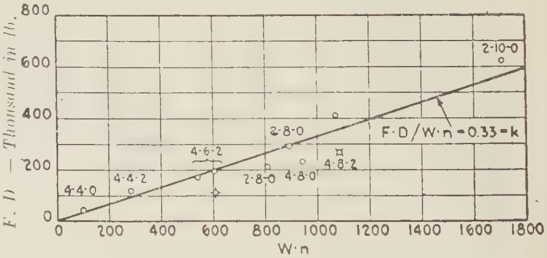
D = the driving-wheel diameter in inches.

F = the machine friction in pounds of drawbar pull.

This equation indicates that with four driving axles carrying a given adhesive weight the machine friction with all drivers coupled will be twice that which will be found if the axles are coupled in two pairs. In the first case, n, the number of group-coupled axles is four, in the second case, two.

In the case of each locomotive studied comparison of the computed with the measured friction shows no greater deviation than is found among the measured values themselves.

The experimental data is plotted in Figs. 1 to 11. In Figs. 2 through 11, the observed friction drawbar pull is plotted against the total measured drawbar pull. Each point is marked to indicate the speed at which the test was run. In a series of tests at one speed it is evident that an increase in drawbar pull must correspond to an increase in cut-off. The plots therefore serve to show the effect, if any, that speed and cut-off have on the value of the machine friction. Through each plot a horizontal line is drawn corresponding to the value



F × D = friction torque = friction drawbar pull × driving-wheel diameter.

W × n = effective weight on drivers = weight on drivers × number of group coupled axles.

Fig. 1. — Relation between friction torque and effective weight on drivers.

of the machine friction derived from the application of equation (1).

From these ten plots is it concluded that :

1. — Precise measurement of the machine friction of a locomotive is difficult. In every plot the individually measured points deviate from their mean value by at least 50 per cent of that value.

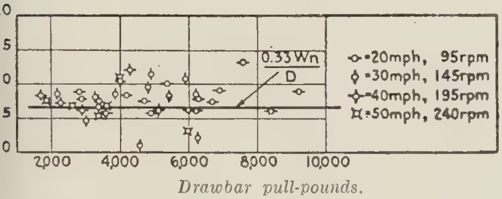


Fig. 2. — Purdue 4-4-0, No. 2. — Superheated.

2. — There is no indication that the machine friction is affected by the speed.

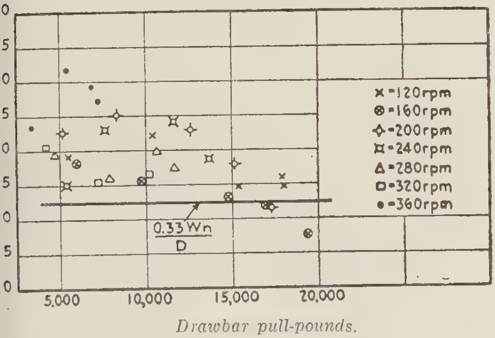


Fig. 3. — Pennsylvania 4-4-2, Class E6s No. 51. — Bulletin No. 27.

3. — In the majority of the test groups there is no systematic change in machine friction as the drawbar pull is changed by changing the cut-off. That is to say, in the majority of the plots the points for the individual tests group themselves about a horizontal line.

4. — In the majority of cases the lines drawn from equation (1) represent the individual tests reasonably well.

Careful consideration of all evidence available has led to the foregoing conclusions, but some details of the plots deserve discussion.

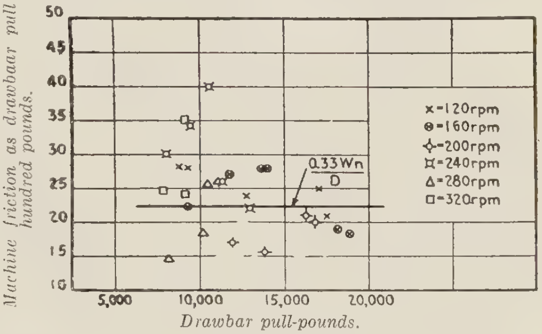


Fig. 4. — Pennsylvania 4-6-2, Class K2s No. 877. — Bulletin No. 18.

In the majority of the plots the individual points show no change in machine friction as the drawbar pull increases. In one case, however (Fig. 10), there is a tendency for the machine friction to drop as the drawbar pull is increased. Two other cases (Figs. 6 and 11) show a reverse effect, the tendency being for the machine friction to rise as the drawbar pull is increased. It is be-

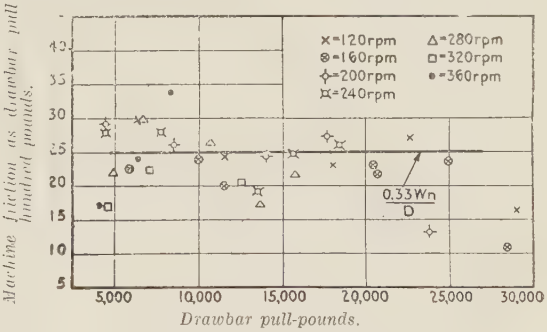


Fig. 5. — Pennsylvania 4-6-2, Class K4s No. 1737. — Bulletin No. 29.

lieved that these variations from the horizontal are accidental. In Fig. 4 the omission of four or five tests at low rates of drawbar pull would level off the plot.

Figs. 6 and 11 showing a tendency for friction to rise as drawbar pull is increased represent, respectively, a 2-8-0 locomotive on the University of Illinois plant and a 2-10-0 locomotive on the Altoona plant. The tests of the 2-8-0, 2-8-2 and 4-8-2 locomotives represented by Figs. 7, 8, 9 and 10 indicate that this rise in friction with increasing drawbar pull is not typical.

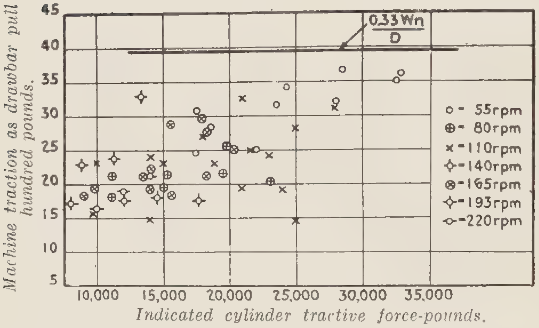


Fig. 6. — Illinois University 2-8-0. — Bulletin No. 82.

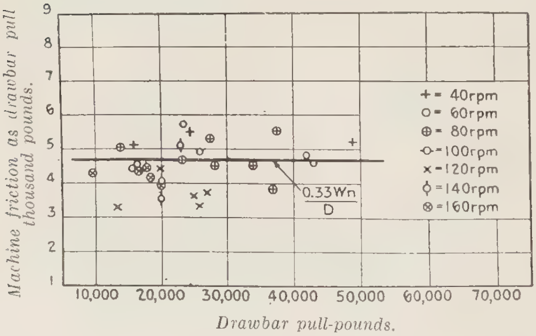


Fig. 7. — Pennsylvania 2-8-0, Class Hbsb No. 387. — Bulletin No. 10.

The very large deviation shown in all of the test groups expresses the difficulty of measuring the machine friction with any high degree of precision. It cannot be measured directly but is found by determining the indicated cylinder tractive force and deducting from this the drawbar pull measured by the dynamometer. The resulting difference is small compared with the measured quantities. If the friction represents 15 per cent of the drawbar pull an uncertainty of 3 per cent in the indicator cards will mean an uncertainty of 20 per cent in the friction. Indicator cards are not likely to be more precise than this and at least a similar lack of precision must be counted on for the dynamometer. Therefore

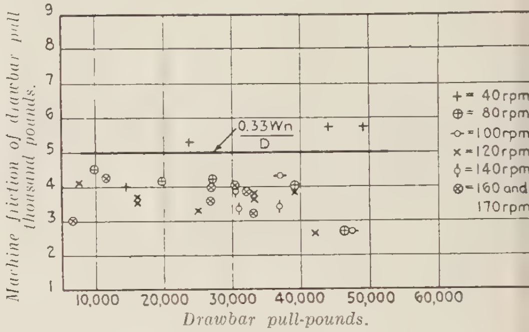


Fig. 8. — Pennsylvania 2-8-2, Class L1s No. 1752. — Bulletin No. 28.

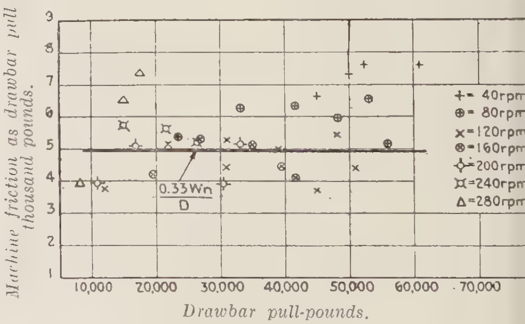


Fig. 9. — Pennsylvania 4-8-2, Class M1 No. 6872. — Test report June 6, 1929.

even under favorable conditions an uncertainty of 40 per cent in the value of the friction will be normal.

Form of the equation.

The form chosen for Equation (1) is based on the following considerations :

1. — The value of the friction drawbar pull must bear some relation to the size of the locomotive, or more directly to the dimensions of cylinders and machinery parts. It is believed that this size effect can be taken into account with reasonable accuracy by assuming that there is direct proportionality to the total weight on driving wheels.

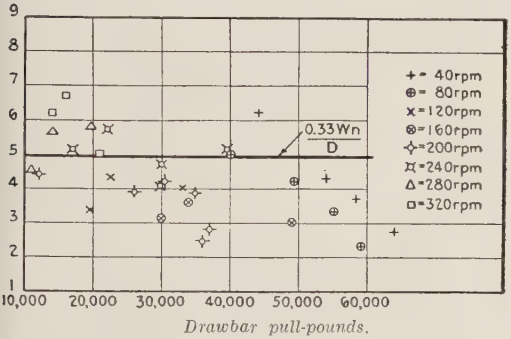


Fig. 10. — Pennsylvania 4-8-2, Class M1a No. 6706. — Test report March 8, 1932.

2. — The experimental data shows that the friction drawbar pull increases more rapidly than the weight on drivers. It is thought that this can be taken into account by assuming direct proportionality to the number of coupled wheels.

3. — The frictional resistance to movement of the machinery originates at the circumference of the driving journals, at the crank pins and in the reciprocating parts attached to the crank pins. This resistance is translated into drawbar pull through the leverage of the driving wheel radius. It is therefore reasonable to assume that the friction drawbar pull is inversely proportional to the driving wheel diameter. It might be argued that the driving journal diameters and the stroke should be brought into account. This may be theorically true, but the experimental data is not precise enough to justify an attempt in this direction.

Derivation of the equation.

Having assumed that the machine friction could be expressed by an expression of the form of equation (1), the ten plots, Figs. 2 to 11, were used to determine the value of the numerical coefficient. If this coefficient is represented by *k*, Equation (1) becomes

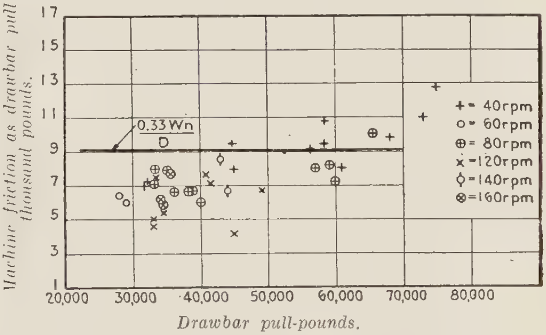


Fig. 11. — Pennsylvania 2-10-0, Class I1s No. 790. — Bulletin No. 31.

$$F = \frac{k.n.W}{D} \quad . \quad . \quad . \quad . \quad . \quad (1a)$$

$$k = \frac{F.D}{n.W} \quad . \quad . \quad . \quad . \quad . \quad (2)$$

In each graph a value was selected for representative of the plotted values of the friction which correspond to the normal working drawbar pull of the locomotive. These values of *F* are given in column 7 of Table 1. From these figures values of *k* were computed by

Table I. — **Dimensions of locomotives.**

1	2	3	4	5	6	7	8	9
Fig.	Locom. type.	Test plant	Locomotive designation	Wt. on drivers, lb.	Driv. whl. dia., in.	From plot F	k	$F = \frac{0.33nW}{D}$
2	4-4-0	Purdue.	N° 2	61 000	69	580	0.327	585
3	4-4-2	Altoona.	E6s-N° 51	101 000	80	1 500	0.425	1 260
4	4-6-2	Altoona.	K2s-N° 877	180 000	80	2 250	0.333	2 230
5	4-6-2	Altoona.	K4s-N° 1737	203 000	80	2 400	0.315	2 500
6	2-8-0	U. of Ill.	...	201 000	63	3 400	0.266	3 900
7	2-8-0	Altoona.	H8bs-N° 387	219 000	62	4 700	0.334	4 650
8	2-8-2	Altoona.	L1s-N° 1752	236 000	62	3 700	0.243	5 000
9	4-8-2	Altoona.	M1-N° 6872	267 000	72	5 700	0.386	4 900
10	4-8-2	Altoona.	M1a-N° 6706	271 000	72	3 700	0.247	4 950
11	2-10-0	Altoona.	I1s-N° 790	342 000	62	10 000	0.362	9 100
				Average			0.330	

Equation (2). These values are given in column 8. The average of the ten values thus found for k is 0.330 and this value has been used in Equation (1).

As a further check, Fig. 1 was plotted. Ordinates represent the values of F derived from the plots (Col. 7, Table 1), multiplied by the driving-wheel diameter. This product represents the torque lost in friction. Abscissae are the values obtained by multiplying the weight on drivers by the number of axles coupled in a group. If the relation of Equation (1) is true, the values plotted in Fig. 1 should fall on a straight line having the slope 0.33. It will be seen that this line gives a conservative representation of the plotted points.

In studying existing reports of measurements of locomotive machine friction it must be understood that an individual measurement may not have a high degree of precision. It is believed, however, that the large mass of data considered provides reasonably accurate figures as to the friction which may be expected in any given locomotive.

Acknowledgment is made of the courtesy of H. W. Jones, chief of motive power, Pennsylvania, for permitting the use of data from the Altoona locomotive testing plant.

[**621**. 133. 1 (.42)]

Oil-burning locomotives of the G.W.R.

(The Engineer.)

Eighteen heavy freight locomotives are being converted experimentally by the Great Western Railway Company at Swindon to burn heavy fuel oil instead of coal. We learn that the first ten will be 2-8-0 tender engines of the « 2800 » class, and that they will be followed by eight 2-8-0 tank engines of the « 4200 » class. While the acute coal shortage is the primary reason for this experiment, which is being carried out in conjunction with the Anglo-Iranian Oil Company. it will also afford useful data for determining the extent to which economies can be effected by the use of oil instead of coal, particularly in respect of the time required for the servicing and preparation of locomotives. It is of interest to note that the railway company estimates that the annual saving of coal which will result from the conversion of the eighteen engines will be about 13 000 tons.

The oil-burning equipment for these conversions, the first of which has now been completed, consists essentially of a weir type burner, an oil-regulating cock and heater, and a steam manifold carrying the necessary control valves. Accompanying engravings illustrate the lay-out.

Oil fuel is contained in a tank, having a total capacity of 1 800 gallons, which is designed to fit snugly into the coal space of the 3 500-gallon well-bottom tender. The front of the tank is lagged with asbestos non-conducting composition, and precautions have been taken to prevent free circulation of air around the sides and back. An oil filler pipe of 4 in. bore runs from the top of the oil tank towards the rear, and then passes vertically downward through the water space to the underside of the water tank, where it branches transversely to provide a filling point at a convenient height on each side of the tender. The oil level is indicated by float gear of conventional type.

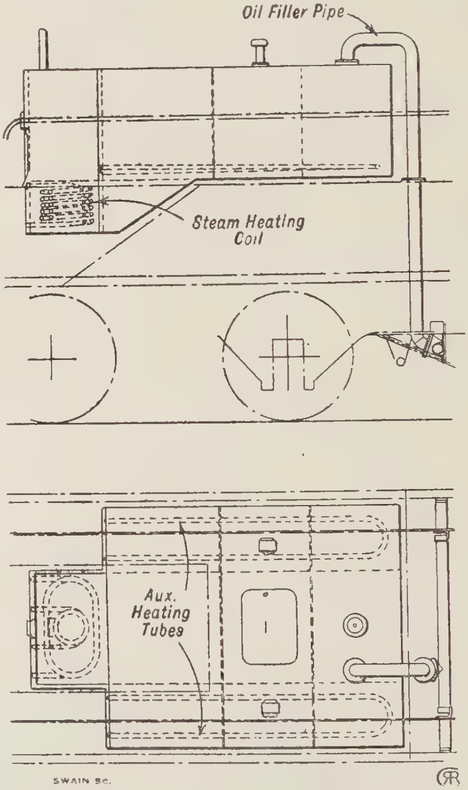
The lower front portion of the tank is

G. W. R. 2-8-0 locomotive converted for oil-burning.

formed into a partially sealed chamber, about 3 ft. 6 in. by 2 ft. 4 in. by 1 ft. 8 in. deep, into which the oil flows through holes in a back partition plate, and from which it is drawn through a stand pipe, 1 ft. 5 in. high. This chamber contains two steam heating coils, with a total heating surface of 29 ½ sq. ft., and is fitted with the bulb of a Rototherm thermometer, the dial of which is carried on the front of the tank. Auxiliary heating loops, each with a heating surface of 8 ½ sq. ft., are fitted one on each side of the main tank. The steam supply to the heating coils is controlled by three valves mounted at the front of the tank on a manifold, which is fed through a flexible hose from the steam manifold on the engine.

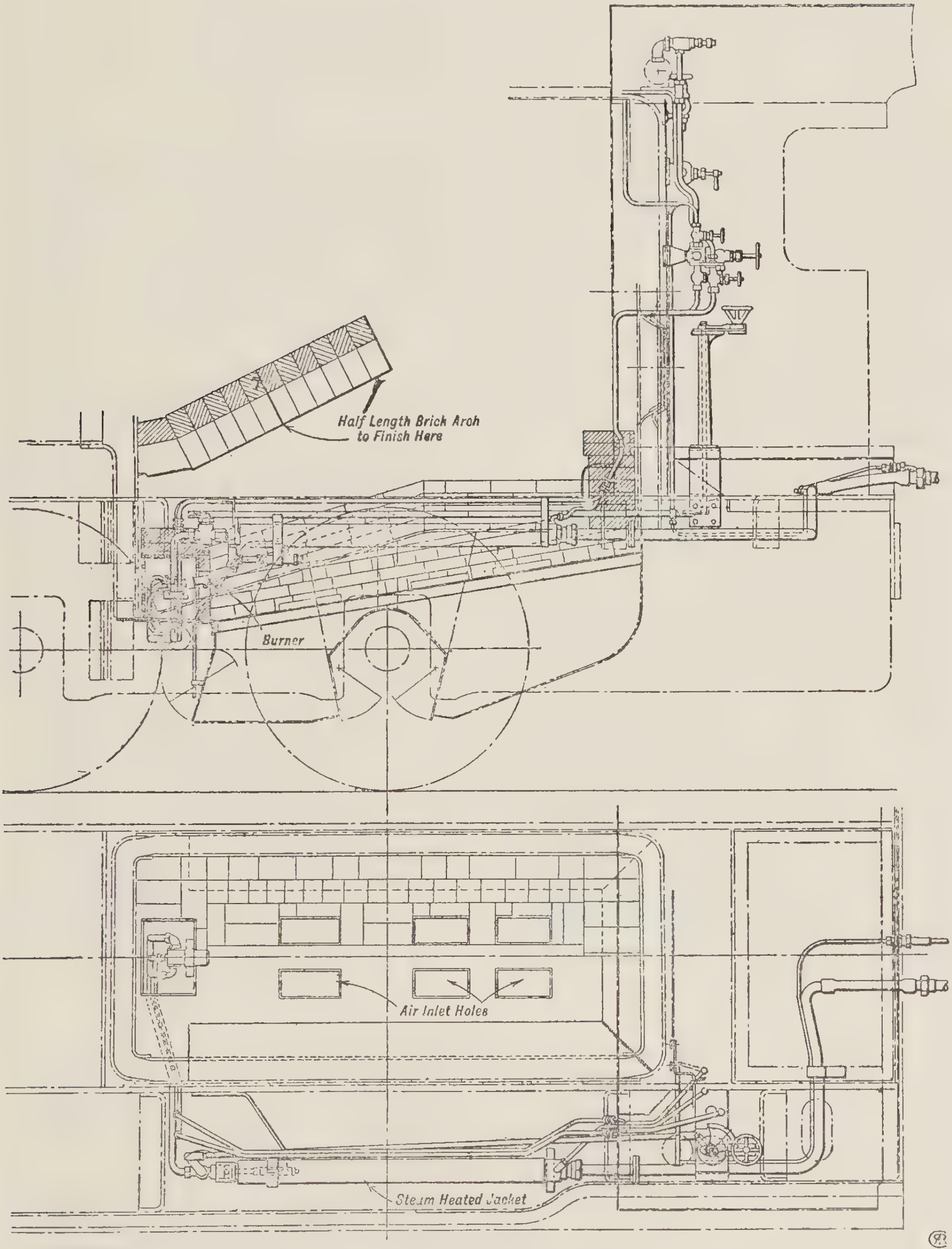
From the standpipe, oil passes through a 2 in. shut-off cock and an Auto-Klean filter, and thence through flexible hose to a 1 ½ in. bore pipe running under the left-hand footplate of the engine. Here it passes through an auxiliary heater in the form of a steam jacket, about 5 ft. 3 in. long, and then immediately through an oil-regulating cock to the burner. The oil-regulating cock is linked to a quadrant graduated in degrees, and is operated through a pinion drive by means of a horizontal control wheel mounted in the front left-hand corner of the cab.

Situated immediately to the right of the oil control wheel is the steam manifold, fed with saturated steam from the boiler fountain. It carries five valves controlling steam to the burner, the burner cleaner, the normal blower in the smoke-box, the oil heater on the engine, and the oil heaters on the tender. A sixth valve on the manifold enables steam from an outside source to be made available at all these points during lighting up, the supply being taken from another engine or from the boiler-washing steam lines in the engine sheds. The steam supply from the manifold to the blower is tapped into the body of the normal blower valve. By this arrangement steam from the auxiliary supply can be fed to the blower while raising steam, and, in addition, the position of the special blower valve close to the other oil-burning controls enables the fireman to operate the blower as required.



Oil tank mounted on tender.

The burner, mounted at foundation ring level in a small chamber at the front of the fire-box, is of the type in which oil flows over a weir on to a ribbon of steam, by which it is caught up, atomised, and projected towards the back of the fire-box at a suitable inclination to the horizontal. The oil orifice is 2 in. wide and 1 ½ in. deep, while the steam orifice immediately underneath is



"THE ENGINEER"

Arrangement of oil-burning equipment.

2 ½ in. wide and 0.018 in. deep. Trials are at present in progress, we understand, to determine the most desirable dimensions of the steam orifice. The chamber carrying the burner has a small bottom damper door, which can be preset to a suitable opening.

At present the floor of the fire-box consists of a steel plate in which are cut six rectangular holes giving a total air inlet of 2 ¼ sq. ft. The normal type of ashpan has been modified to provide a suitable firepan, the original damper gear being retained. The air supply to the fire-box through the orifices in the floor is controlled by opening or closing the damper doors in the firepan. Firebricks, supplied by E. J. and J. Pearson, Stourbridge, having a high alumina content, are used to line the floor and the lower part of the fire-box, while a standard brick arch is fitted to the first engine. We are informed that further experience may indicate the desirability of a shorter arch or even its abolition, as indicated on the drawing.

Other modifications include the redesign of the fire-hole door to form a reasonably effective seal. While the door can be easily opened, it is effectively locked when in the shut position. A peep hole with cover is provided. The normal spark plates have been removed from the smoke-box, and experiments are in progress to determine the best diameter for the blast pipe orifice.

It is intended to use all the converted engines in South Wales for coal and freight traffic, and it is anticipated that for the tender engines runs of about 250 miles will be possible between refuellings. The tank engines will have a more limited range, since space limitations restrict the total capacity of the tank to about 850 gallons.

Two refuelling depots, one at Llanelly and the other at Severn Tunnel Junction, are under construction, and are nearly completed. At each depot the storage capacity will be 36 000 gallons of fuel oil, contained in three 12 000-gallon tanks, which will be replenished from travelling tanks, each of 3 000 gallons capacity. The oil from the travelling tanks, four of which will be dealt with at a time, will be transferred through flexible hose pipes to the storage tanks by a steam-driven horizontal duplex pump, at an estimated rate of 10 000 gallons per hour. To render possible this rate of flow, the viscosity of the oil will be reduced by steam heating both the travelling tanks and the oil pipe lines. For refuelling the locomotives, the same pump and pipe lines will be used, but with the connections to the pump reversed. For this purpose the storage tanks will be steam-heated, and the temperature maintained at the required level by suitable thermostatic control apparatus.

The storage tanks for these installations have been supplied by Robert Jenkins and Co., Ltd., Rotherham, the steam pumps by J. P. Hall and Sons, Ltd., Peterborough, and the flexible hose by W. H. Willcox and Co., Ltd., London.

[621. 131. 1]

Comparable locomotive ratings,

by F. E. WYNNE,

Consulting Transportation Engineer, Westinghouse Electric Corporation.

(Railway Age.)

The purpose of giving any machine a rating is to provide an indication of its capabilities in service and to give a means of comparing different machines which may be adaptable to the same work. To quote from the Standards of the American Institute of Electrical Engineers : « A rating is arbitrary in the sense that it must necessarily be established by definite fixed standards and cannot, therefore, indicate the safe operating limit under all conditions that may occur in service. » In this discussion, we are not concerned with the details of determining the rating of any type of locomotive, but we are intensely interested in discovering what data the rating should give in order that the locomotive's serviceability may be evaluated and two or more types may be readily compared. This discussion applies primarily to road locomotives and to some transfer locomotives. Switchers in flat yard service are generally capable of handling any trains which they can start and accelerate to a satisfactory speed. Locomotives for hump service require special consideration because of the great tractive force required at low speed for long periods of time. Hence, consideration of switching and hump locomotives is not included here.

Present status.

The output of a locomotive which is useful in moving itself and its train is developed at the points of contact between the driving wheels and the rails. Present practice uses locomotive ratings which are not comparable. Usually, the steam locomotive is rated in maximum cylinder horsepower and part of the cylinder output is consumed in machine friction between the cylinders and the drivers. The Diesel locomotive commonly carries the rating of its Diesel engine and part of the engine output is used to drive auxiliaries while another part is lost in the electrical transmission between the engine and the drivers. The electric locomotive is rated at the horsepower which its drivers will deliver at the rails continuously. Hence, locomotives having the same conventional rating may differ widely in useful output at the drivers. The following tabulation illustrates this fact :

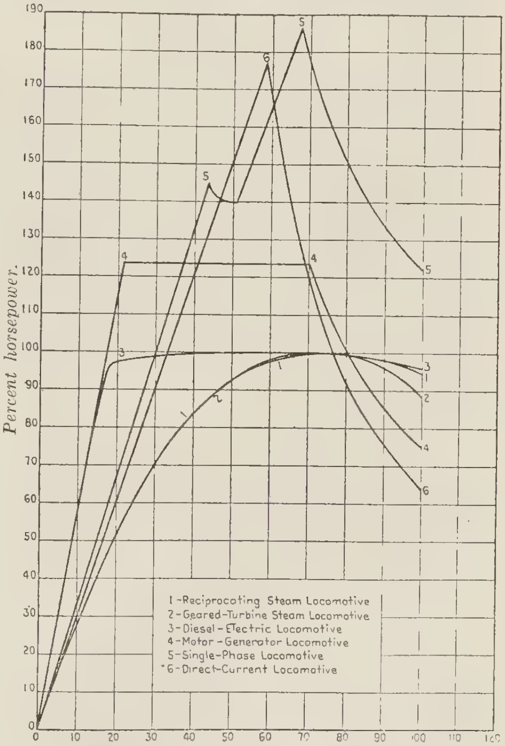


Fig. 1. — Maximum horsepower as per cent of continuous horsepower.

Kind of locomotive	Present conventional rating	Continuous useful output at drivers	Weight of cars that can be hauled at 100 m.p.h. on level tangent track
Steam	6 000-hp. cylinder output	5 320 hp.	1 000 tons
Diesel	6 000-hp. diesel engine output	5 050 hp.	900 tons
Electric	6 000-hp. continuous output	6 000 hp.	1 300 tons

From this, it is seen that the useful output at the drivers, commonly called « rail horsepower », is now different for types having equal conventional ratings.

Train weights.

The example shows further that the sizes of train which can be hauled at a selected speed by the several kinds of locomotive differ much more than their useful outputs at the drivers. This is because the types are inherently different in weight and the heavier locomotives consume more of the rail horsepower and leave less for pulling the cars. However, the total weights of locomotive and train are more closely related to the rail horsepower. Consequently, rail horsepower is a good indication of the comparative total train weights which can be handled by locomotives of different kinds or sizes. The approximate tonnage of trailing load may be derived by deducting the weight of locomotive (and tender, where used) from the total train weight.

Off-hand it might seem that the serviceability of a locomotive would be indicated more directly by rating the locomotive in output at its drawbar. This would eliminate differences in locomotive weights but it introduces variation in speed, grade and curvature which are continually occuring on any railroad. Even a locomotive that develops constant rail horsepower over a wide range of speed would have a different rating at its drawbar for each change of speed, grade or curve. Hence, a single drawbar rating appears to be inadequate and impractical. On the other hand, as will be developed later, a suitably selected rating in rail horsepower will adequately indicate locomotive service capacity over a wide speed range and also serve as a basis for comparison.

Characteristic curves.

The necessity for establishing a uniform basis of rating locomotives is emphasized by considering their typical characteristics. Fig. 1 shows the maximum performance that can be developed by each of six types of locomotive regardless of time. Where electrical apparatus is used, a considerable part of this maximum performance can be

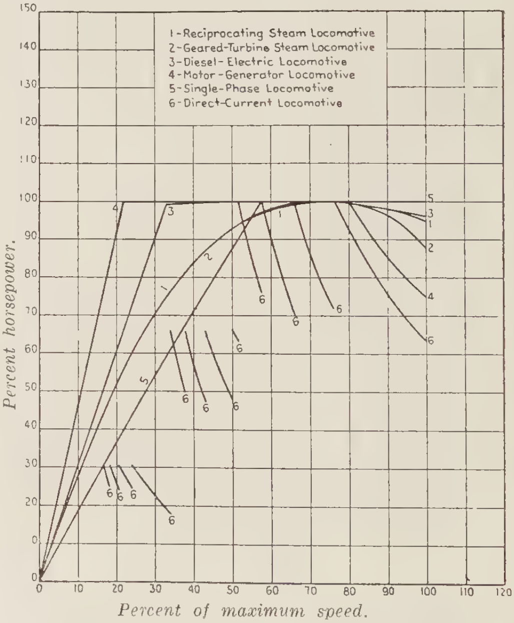


Fig. 2. — Continuous horsepower at each speed as per cent of maximum value of continuous horsepower.

used for limited times only. While these short-time capabilities are valuable in making rapid accelerations, in ascending short grades, and in quickly recovering from speed restrictions, the overall performance must be kept within the continuous capacity of the electrical equipment.

Fig. 2 shows continuous capacity curves for the same six locomotives. It is interesting to note that five of these locomotives develop the same maximum value of continuous horsepower at approximately 70 per cent of maximum speed. At this speed the continuous capacity of the particular direct-current locomotive used is 14 per cent less than that of the others. This indicates that with the discontinuous character of this locomotive's curves, it may have less overall service capacity in spite of its short-time maximum capabilities, shown in Fig. 1. In Fig. 3, the same curves are shown but the rated continuous capacity is taken as the value shown at 70 per cent of maximum speed. This makes practically no change from Fig. 2 except that the direct-current curves are raised so that the upper group of them averages about the same as the others.

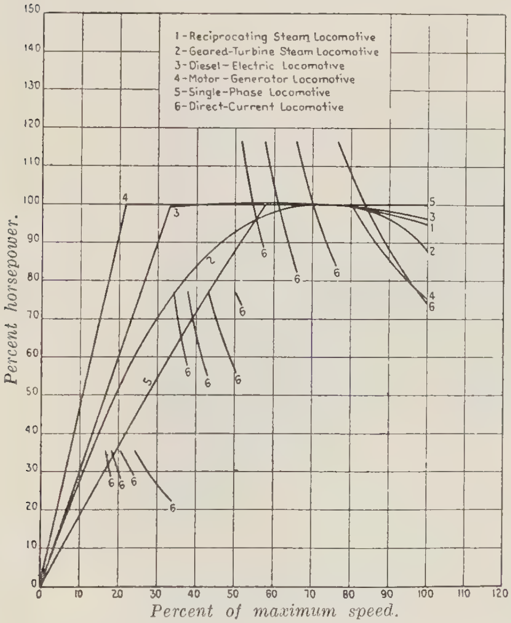


Fig. 3. — Continuous horsepower at each speed as per cent of continuous horsepower at 70 per cent of maximum speed.

Proposed rating.

When rated at 70 per cent of maximum speed, and where the major portion of the operation is within the upper half of the speed range, it is believed that locomotives of equal rating and designed for the same maximum operating speed will give substantially the same service performance when handling the same total weight of train, including locomotive and tender, if used. Where operations below half speed are controlling, the motor-generator and Diesel-electric types tend toward better performance than the steam types, while direct-current and single-phase locomotives tend toward somewhat less than steam performance with the same total train weight. Because of the inherent lower weight of electric locomotives, they will outperform equally rated steam and Diesel-electric locomotives in the upper half of the speed range when handling only the same number of cars and tend toward performance equal to that of steam locomotives in the lower half of the speed range.

It is, therefore, proposed that each locomotive be designated by its continuous rating at 70 per cent of the maximum operating speed for which it is designed and built, in order that the objective expressed at the beginning of this discussion may be met.

Rail horsepower is proportional to tractive force and speed. The same horsepower may develop great tractive force at low speed or small tractive force at high speed. Consequently, the rating of a locomotive should give not only the rail horsepower but also the corresponding speed and tractive force. To safeguard the applications of motive power to some extent, the maximum safe operating speed, starting tractive force, and continuous tractive force also should be specified. To give an indication of short-time overload performance, the maximum rail horsepower should be stated.

This information can be shown in tabular form, which for a certain locomotive would be :

Rating — 6 000 hp. — 32 000 lb. tractive force — 70 m.p.h.
Maximum operating speed — 100 m.p.h.
Starting tractive force — 82 500 lb.
Continuous tractive force — 40 000 lb.
Maximum output at rails — 12 000 hp.

On this basis, all locomotives of equal rating should be roughly capable of equal continuous performance within the upper half of their speed range. Differences which appear in values of starting tractive force, continuous tractive force and maximum output for two or more equally rated locomotives will indicate their relative values for accelerations and running below half speed together with their relative abilities to maintain schedules over a profile which intermittently imposes overloads for brief periods.

For accurate determination of performance in service, it is, of course, necessary to have the speed-tractive-force characteristic curve of each locomotive and to develop from it the speed-time and distance curves when hauling the desired train over the specified profile with the designated stops and speed restrictions. Where electric drive is used, the time-temperature characteristics of the electrical equipment also are required.

Because of the inconsistency and inadequacy of present practice in rating locomotives, a uniform method of rating motive power is most desirable, if not imperative.

It is suggested that :

a — Locomotives should be rated in output from the drivers at the rails.

b — The rating should give continuous horsepower with the corresponding tractive force at 70 per cent of maximum operating speed.

c — As supplementary information for approximate applications and comparisons, the maximum output at the rails, maximum operating speed, starting tractive force and continuous tractive force should be given.

For exact application to a specific service, the speed-tractive-force characteristic curve of the locomotive should be available together with time-temperature data where electric drive is used.

[**625.** 214 (.73)]

New York Central develops hot-box alarm.

(Railway Age.)

After a period of development and testing which has been in progress since 1933, the New York Central has evolved a practical hot-box alarm which it has now programmed for general installation on its passenger rolling stock and locomotives. The alarm system employs two indications — smoke for observation outside the train to identify the overheated box, and a distinctive and unpleasant odor which conveys the message to the interior of the train. The alarm was designed primarily for application to friction bearings, but has been adapted to and is being installed in roller-bearing journal boxes.

In its latest form this alarm consists essentially of two containers or « cartridges » which are placed in cavities provided in the bearing for that purpose. Each cartridge is filled with a different liquid and has a small orifice sealed with a fusible metal which melts at a predetermined temperature and releases the liquid. At this temperature the liquid vaporizes as fast as it can escape through the orifice. The liquid from one cartridge produces a distinctive and penetrating odor and that from the other a dense white smoke, both of which give warning of an over-heated bearing. The discharge continues until both cartridges are empty, which requires from eight to ten minutes.

Smoke from a friction-bearing cartridge escaping from the journal box.

The liquid used to produce the odor is ethyl mercaptan and the smoke-producing liquid is a mixture of titanium tetrachloride and carbon tetrachloride. The gases from both of these liquids are non-corrosive and, when diffused in the atmosphere, can be inhaled without harmful effect. For the fusible element the melting temperatures that have been found most satisfactory are 220 deg. F. for roller-bearing applications, 320 deg. F. for waste-packed friction bearings, and 450 deg. F. for grease-lubricated friction bearings. All three of these temperatures are substantially above the normal running temperatures of bearings of the respective types. Some years ago the New York Central conducted a series of tests which disclosed that carbon steel axles in the normal 40-55 carbon range are not adversely affected by temperatures up to 525 deg. F.

The cartridges for friction bearings are thin-wall brass tubes 5/8 in. in outside diameter. These tubes are of two lengths, 7 in. and 8 in. The shorter tubes are for 5-in. by 9-in. brasses and the longer ones for all other bearings. The ends of these tubes are fitted with brass cap seats, with inside taper threads, which are sweated in place. In the seat is screwed a fusible plug. The finding of a satisfactory closure of the tubes was one of the most difficult phases of the development of successful cartridges. The taper threads are 40 per in.

To distinguish readily between the two types of cartridges the plug for the odor cartridge has a hex head and that for the smoke cartridge, a square head. The head of each plug is also stamped with a number which indicates the melting temperature of the fusible metal with which it is filled. When loaded and plugged the cartridges are tested in hot water at 200 deg. F. for ten minutes to detect any lack of tightness in the closure.

The journal bearing is drilled longitudinally to provide cavities of suitable depth to receive the cartridges. These cavities are located just inside the sloping sides of the brass where the metal is thickest. The cartridges are retained in the brass by Hubbard expansion plugs (dished washers), which are pushed into shallow cylindrical countersinks at the ends of the cavities.

The loaded cartridges are placed in the bearing by the manufacturer and require no attention thereafter unless and until they are subsequently discharged by an overheated bearing, when, of course, they must be replaced.

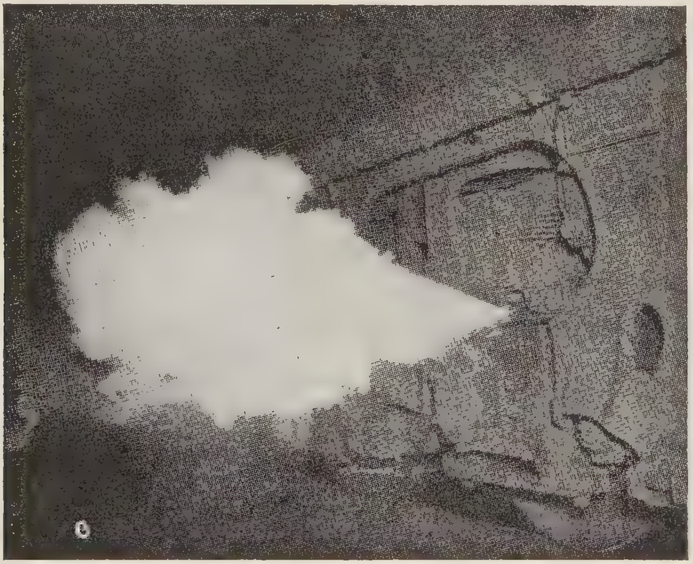
The cartridges for roller-bearing boxes are formed of thin steel and are 1 1/4 in. in diameter by 1 7/8 in. long, closed by a welded cover in the center of which is a fusible plug. These are inserted in pockets in the face of the roller-bearing housing. Ears which project out from the end of the cartridge fit into recesses in the face of the housing, in which they are secured by peening over the metal at the edges of the recesses.

Early tests.

The first test in road service was made in August, 1933, on a branch line. For this test a dummy journal box was attached to the underframe of a Pacific type locomotive tender. Artificial heating was produced by an electric heater and small capsules containing the specified materials were thus discharged en route. Observers stationed in different cars of the train all reported that the odor was so strong that it could hardly have escaped attention by any member of the train crew. This test did not, however, represent main-line conditions, and the train included no air-conditioned cars.

On July 16, 1934, the first observations were made on a main-line revenue train. It was found that the odor from the alarm was plainly noticeable in both air-conditioned and non-air-conditioned cars. This was still not considered conclusive, however, because the container used to represent the journal box was well ventilated, a condition favorable for the escape of gases from the alarm.

On August 9, 1934, a third series of main-line tests was made. In these tests a standard journal box equipped with an articulated lid was suspended as before underneath the tender. The journal-box lid was of the ventilated type but tests were made also with the ventilators tightly plugged, so that conditions simulated those in service with the tightest known friction journal box. Evidence of the effectiveness of the « smoke », as well as the odor, of this alarm was developed unexpectedly during these tests when the train was stopped by a tower man because he saw the smoke of a « hot box » and did not know that it was artificially created.



Discharge of a smoke cartridge in a tender roller-bearing journal box.

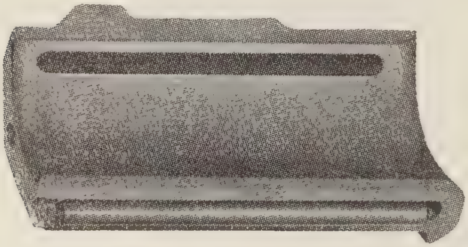
These three tests established beyond question the fact that the odor of the hot-box alarm is strong enough so that it can hardly escape detection by the train crew, and that this is equally true whether cars are air conditioned or not. The odor is noticeable for about five minutes.

About the time the first of the road tests was made, several tender bearings on a switch engine operating in passenger helper service out of Albany were equipped with this alarm for the purpose of determining whether any of the materials, including liquids, used would show deterioration as a result of age, vibration and repeated heating and cooling. These bearings, when removed on account of wear after about two years of service, were sent to West Albany laboratory for examination. The hot box alarms were found intact and, when set off by heating in an oil bath, were found to function at the stipulated temperature with no apparent loss of effectiveness.

Tests on friction bearings.

Beginning in October, 1934, 500 alarm-equipped bearings were applied to J-1 class 4-6-4 type locomotive tenders. Later 500 additional applications were made to K-3 class 4-6-2 type tenders and a small number of passenger coaches. These applications were followed as a service test and care was taken at the outset to acquaint the train crews with the application. Small bottles of ethyl mercaptan were distributed so that the crews could become familiar with the nature of the odor released when the alarm functioned.

The cartridges for this initial application were somewhat crudely made and several false alarms were given by leaking cartridges. However, in the two-year period ending November 1, 1936, attention was called to 16 actual cases of hot-boxes by the functioning of the alarm device.


Section through a friction bearing showing a hot-box-detection cartridge in place.

Typical of these cases is one which occurred on October 25, 1936, in which the left No. 3 tender journal box was discovered running hot by the odor discharged by the hot box alarm. The bearing was found with the lining melted out and the brass cracked. Some two and a half years earlier the left No. 3 tender journal box on this same train ran hot at about the same location. It was not equipped with a hot-box alarm and was not discovered until the journal had burned off and the entire train of nine cars had been derailed.

On October 15, 1937, 1 000 additional applications were authorized. These were applied more or less promiscuously to locomotive tenders and cars of various types over a considerable period of time. Because of the trouble experienced with these miscellaneous and scattered applications, all of which could be traced to defects, principally leaky cartridges, it was decided to defer further applications until a more satisfactory cartridge had been developed. A new design of cartridge was produced and all crown brasses of L-3b and L-3c locomotives were equipped with them in 1941 and 1942 by the builders. All L-3b locomotives have now completed at least one shopping period and there have been no reports of leaking cartridges on these locomotives.

In application of this type of hot-box alarm to roller bearings only one cartridge was applied to each bearing. The smoke-producing cartridge was omitted because the roller-bearing manufacturers considered it unnecessary. The first applications to roller bearings on the New York Central were made in 1937 to four new combination mail-baggage and six new dining cars. The Pullman Company was requested to make similar application to new Pullman cars under construction for the New York Central. These experimental applications were gradually extended until hot-box alarms were in service on 312 passenger train cars of all kinds and on one or more classes of bearings of 174 locomotives, 75 of which have complete installations on all engine and tender bearings.

The experience in roller-bearing service is less favorable than with friction bearings. Most of the trouble on the New York Central was caused by defective cartridges. It is sometimes difficult in a roller bearing to locate the cartridge so that the fusible element will be sufficiently close to the source of heat generation to respond promptly to over-heating.

From January 1, 1942, to October 15, 1943, 61 leaking or discharged hot-box alarms were reported in roller-bearing boxes, the bearings of which were found not overheated and were continued in service. During the same period six roller-bearing failures occurred in which it was reported that the hot-box alarm did not discharge. In the case of 14 other failures the alarm functioned as intended; serious damage was averted.

Inserting a hot-box-detection cartridge in a trailer-truck roller-bearing housing.

It was found that cleaning of roller-bearing boxes in a solution having a temperature of around 200 deg. F. was causing the fusible plug, which melts at 220 deg. F., to leak, so instructions were issued at the end of October, 1942, to clean these boxes in a solution having a temperature not exceeding 160 deg. F. It was also learned that some inspection points made a practice of rubbing the end of the hot-box alarm with a packing iron and then smelling the iron to see if the alarm was leaking. This practice has been discontinued because of damage to the fusible plug. Such action is not required to detect a leaking alarm.

In order to guard against defects of manufacture it is now required that all cartridges, after filling, be tested in water at a temperature of 200 deg. F. for five to ten minutes for leakage. Leaky cartridges can be detected without difficulty by this test. When cartridges are removed from the bearing during repairs at the shops, or for any other reason, a similar test is made before they are reapplied.

Relocation of hot-box alarms in roller-bearing boxes to place them nearer the rollers and races in order to reduce to a minimum the possibility of failure to discharge when the bearing fails is under consideration by the roller-bearing manufacturers. It has been found impracticable, however, to relocate the alarms in some of its existing bearings.

The experience of the New York Central has led to the conclusion that the smoke-and-odor type of alarm provides a practicable means of assisting train crews and others on duty along the right-of-way in the detection of hot boxes of either the friction- or the roller-bearing type before serious trouble develops. The first cost is believed to be much less than that of any other type of hot-box warning device now available, and only routine maintenance attention is required during the life of the bearing; furthermore, the average costs are expected to be reduced in the course of time by the reclamation of cartridges and their reapplication to other bearings.

Believing that fully satisfactory results cannot be attained unless the applications are sufficiently extensive so that train crews, crossing watchmen and maintenance men can be properly instructed and become familiar with the device, the New York Central has embarked upon a program of application which includes all new roller-bearing passenger-train cars, all head-end passenger-train cars with friction bearings, all air-conditioned passenger cars with friction bearings, and all high-speed passenger locomotive bearings. This involves the installation of cartridges in more than 35 000 bearings.

The alarm is protected by patents and patents pending, and is known as the Twinplex Hot-Box Alarm. Friction bearings equipped with this alarm are furnished by the Magnus Metal Corporation under an agreement which stipulates that they will also license other bearing manufacturers to apply the alarm, provided cartridges are purchased from Magnus. Alarm-equipped roller bearings are furnished by the Timken Roller Bearing Company and this company also supplies the cartridges for application by other roller-bearing manufacturers.

Both the Timken and the Magnus companies cooperated with the New York Central in the development of this device.

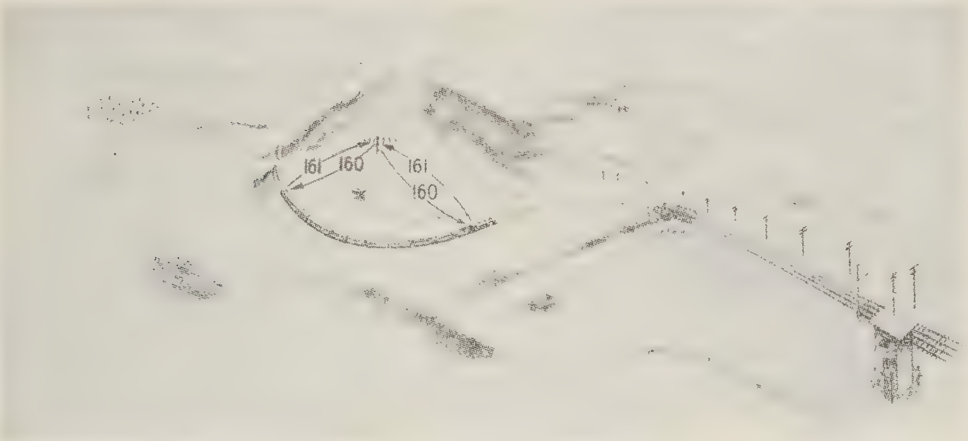
[656. 254 (.73)

Experience with VHF radio,*

by L. J. PRENDERGAST.

Superintendent communications, Baltimore & Ohio, Baltimore, Md.

(Railway Mechanical Engineer)



Wayside VHF communication system using telephone wire station interconnection.

On the Baltimore & Ohio our train communication tests have been confined exclusively to the use of very high frequency radio and we have no personal experience with the so-called « carrier system ». It is our opinion that for yard and terminal operation, VHF radio has definite advantages over the inductive system, that the same advantages exist for front-to-rear train communication, but that in the field of talking from the train to a wayside point or the division office, the advantages of radio are not as pronounced and we hold an open mind concerning the relative advantages of radio or carrier to this particular type of application.

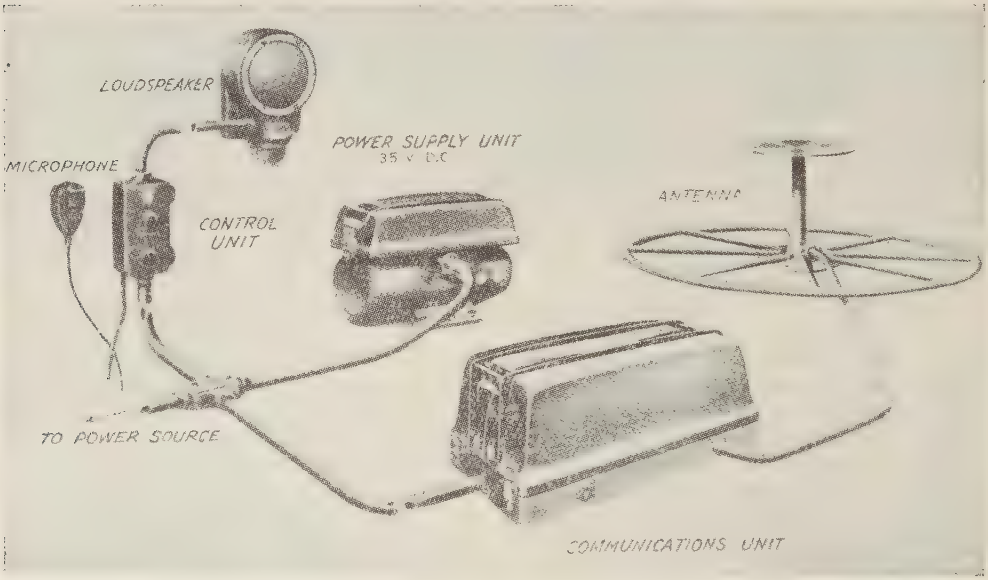
Tests show more than line-of-sight transmission.

We have made extensive tests in the Baltimore, Md., terminal area. This, incidentally, is our largest and most important terminal point consisting of five major yards with numerous transfer runs between the yards and also a considerable number of interchange movements with foreign roads each day. One antenna was used for the fixed station in our Baltimore test and was located on the roof of the Baltimore & Ohio building, a 13-story building, located nearly in the geographic center of the downtown portion of the city. From this station, it was possible to cover our entire Baltimore area. The frequency used for these tests was 156.25 megacycles.

Theoretically, radio transmission at frequencies in the neighbourhood of 160 megacycles is supposed to have a « line-of-sight » range; that is, you transmit where you can see. Very early in our Baltimore tests, it was quite apparent that we were receiving intelligible radio signals where « line of sight » conditions could not exist and as the tests progressed it became evident that in urban areas with large masonry buildings containing quantities of glass areas, these were acting as efficient reflectors resulting in multiple path transmission and signal reinforcement and insuring good signal levels entirely beyond the line of sight under some of the worst imaginable conditions.

---

* Abstract of a paper presented before the Southern and Southwestern Railway Club, Atlanta, Ga., January 17, 1946.



Complete communication apparatus for a caboose or locomotive, exclusive of the power source.

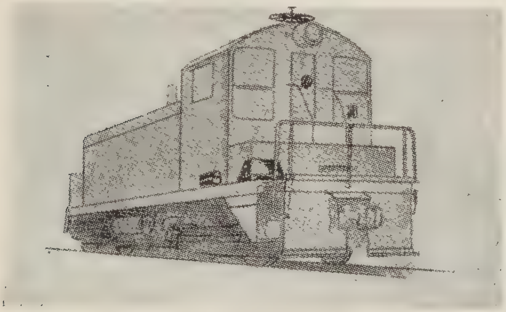
On our tests in the Baltimore area, good transmission was effected to all points in the Baltimore terminal from the one station located on the Baltimore & Ohio Building.

The results in the Baltimore area were sufficiently satisfactory to justify the management in authorizing the equipping of the railroad's New Castle, Pa., yard with radio to promote the efficiency of yard operation. New Castle is a large hump yard and severe fog conditions frequently exist. This was the primary reason for installing the apparatus at New Castle — that is, to use it for hump engine operation, especially to keep them working in thick weather. It has been found, however, since the installation was made that it is of value in communicating with the trimmer engine and has been used on some occasions to dispatch a switch engine to a line-of-road job to meet an emergency condition.

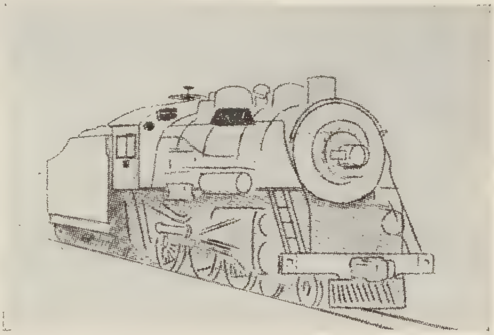
The Transportation Department of the Baltimore & Ohio is quite convinced that the use of radio in yard and terminal operations will result in sufficient tangible savings to make the installations attractive from the standpoint of economics. We are not quite so convinced from a dollar and cent standpoint for front-to-rear and wayside-to-train applications. It must be remembered that on the Baltimore & Ohio, as on most of the other eastern trunk line railroads, our heavy traffic is moving on multiple track routes. These same economic advantages might not exist if we were dealing largely with single track operation on our heavy traffic density lines.

Equipment used.

The tests we have made and the permanent installation we have at New Castle have been made with apparatus manufactured by the Bendix Radio Division of the Bendix Aviation Corporation. The radio apparatus which is contained in a cast aluminium case is shock mounted, the assembly can be removed from the case for maintenance purposes and a new unit substituted in a matter of minutes. The power unit is mounted similarly to the radio equipment for easy replacement. The antenna consists of a counterpoise in the form of a cartwheel which is mounted directly on the roof of the car, caboose, or engine tender and from the center of which, and extending for 14 inches, is a vertical radiator used as the actual antenna. The control box has a switch for connecting channel one, channel two or switching off. The sets we are using at present have two frequencies available for both transmitting and receiving so that two channels of communication may be provided. The loudspeaker, microphone, control unit, power supply unit, communication unit, and antenna are all shown in the illustration as being connected together by means of rigid conduit. This apparently is the most effective way of wiring up the various individual components.


Location of communication equipment on a Diesel switcher.

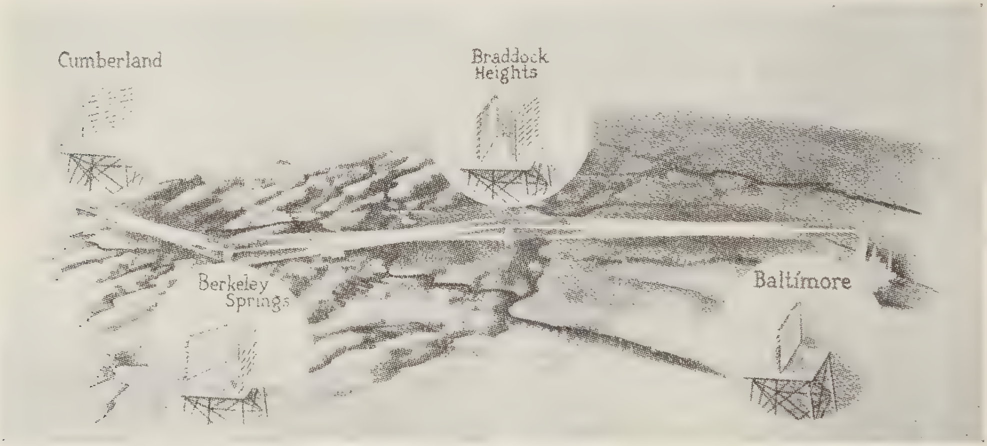
Another advantage of VHF radio is that the wave length at 160 megacycles is about two meters long. The length of the antenna is usually 1/4 of a wave length, or 1/2 a meter. It means that the antenna as a vertical radiator would be between 15 and 20 inches long. This is an important consideration in railroad usage because of the close clearances ordinarily encountered. In fact, some recent tests we have been conducting on passenger equipment indicate that with an antenna 14 inches high we will have difficulty in meeting clearance conditions on our raildroad. At one point, maximum clearance is just 15 ft., and at several points is between 15 ft. 3 in. and 15 ft. 6 in. In most of the passenger cars that we have encountered, the roof is 14 ft. above the rail and it appears that this particular problem of installations on passenger equipment is one to which more study will have to be given. In the case of cabooses and engines, the clearance requirements are less strin-


Proposed method of placing equipment on a steam locomotive.

gent as the antenna can be mounted on the tender of the engine and on the roof of the caboose below the cupola.

We have made tests covering front-to-rear end communication on freight trains and these tests also, from a radio standpoint, were very satisfactory. The only time that communication was interrupted was when the train was in a tunnel. Some thought has been given to the question of continuous communication through tunnels and the Bendix Radio Division is at present conducting a test in 2 700-ft. tunnel on the Baltimore Division of the B. & O. to determine if communication can be effected through tunnels as long or longer than this one. These tests have not progressed to the point where we can definitely determine if a solution has been reached or not. There is some question of justifying the cost of reception through tunnels inasmuch as tunnels represent such a very small percentage of our total road mileage.

We have ordered ten Walkie-Talkie sets for experimental purposes but have not as yet received delivery. There apparently are many places in railroad operation where small sets of this type may fill a long felt need. Signal maintainers, in adjusting the shunt resistance of track circuits, may use them to talk back and forth between the battery location and the location of the shunt resistance. Signal maintainers could also use them effectively in focusing automatic block signals. The foreman of the relief train might utilize such a medium of communication to good advantage in talking to his force at derailments of other pile-ups and section forces could probably make good use of them in numerous ways.



Relay point-to-point VHF communication.

Maintenance to be joint responsibility.

The question of maintenance of this equipment is an important one. The subject has been investigated by the Eastern Conference Committee, and on the Baltimore & Ohio, and I think on most of the other eastern railroads, the Motive Power Department will be responsible for the installation and maintenance of the radio apparatus on locomotives, cabooses, and all other rolling stock. The Communications Department will be responsible for the installation and maintenance of apparatus at all fixed locations. One of the requirements of the Federal Communications Commission is that only persons holding at least a second-class telephone or telegraph operator's license may make any adjustments to the transmitter equipment or repair any defects which may appear in the transmitters. On the Baltimore & Ohio, such licensed personnel will be largely confined to employees of the Communications Department. We have several such employees on our payroll now, and will probably need additional ones. It is proposed that the electrical force of the Motive Power Department will merely replace the defective unit with a good one held in stock for that purpose, and that the defective apparatus be turned over to the Communications Department for check and repair at a centralized service shop. It is felt on our road that this will enable us to maintain these sets in the most economical manner and will avoid complications with shop electricians, many of whom could not pass the tests for federal licenses.

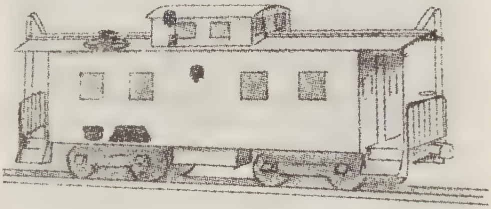
The tests are conducted throughout the country by the local radio inspectors of the Federal Communications Commission and consist of written examinations in radio theory and in radio law and commission regulations, and in the case of telegraph licenses, proficiency in the International Morse code. While the test is not too difficult for an experienced radio mechanic, it might present substantial difficulty to a more elderly electrician, who is not familiar with electronic circuits at all. There is no charge for the test, nor for the issuance of the license.

Commission requirements.

The Federal Communications Commission has recently issued two important orders in connection with railroad radio. Its order No. 126, dated August 21, 1945, provides that railroad personnel using radio transmitters and receivers in the usual course of their business need not be licensed by the commission but must be examined by the railroad rules examiner at bi-annual intervals on simple rules relating to radio, with which the commission feels all persons using a transmitter should be familiar. Records must be kept by the railroad of such examinations, and these records are subject to periodic inspection by a representative of the commission. This concession on the part of the commission represents the first time the commission has waived its usual requirements that all persons using radio transmitters must be licensed directly by the commission. The other order, issued December 20, 1945, embodies the actual operating and technical requirements under which railroad radio service must be carried out. These rules are sufficiently broad so that no railroad should feel alarmed concerning any of their provisions. The rules were worked out through the cooperation of the Association of American Railroads and the staff of the Federal Communications Commission.

Power supply.

The question of power supply for these radio sets located on railroad rolling stock is one that has received considerable attention in the last year or so.

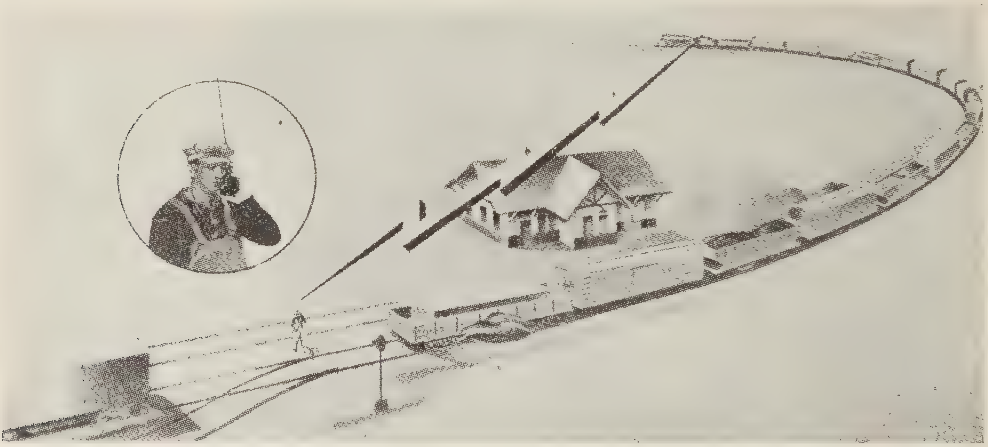


Typical caboose installation.

The Mechanical Division of the Association of American Railroads has had a sub-committee actively working on this program and some progress has been made by this sub-committee. The Communication Section and the Mechanical Division have held joint committee meetings and it has been decided, as an association policy, that all transmitters and receivers, both for fixed stations and for installation on rolling stock, shall operate at a voltage of 117 volts a. c., 60 cycles. This decision, of course, is a compromise between several conflicting opinions and conflicting reasons. The advantages gained by standardizing on this voltage are that all of the sets, both fixed station and rolling stock, are completely interchangeable and that no conversion equipment is necessary at test benches where service work is performed. It assists the set manufacturers in standardizing and permits the railroads greater ease in making comparative tests.

Rolling stock at the present time will ordinarily have 32 volts d. c. supply on passenger equipment and on steam locomotives. The supply on Diesels varies, but 64 volts and 110 volts are relatively common voltages. It is thought that in the case of steam locomotives, independent turbo-generators supplying 110 volts a. c. may be used, or, I understand, that one of the larger manufacturers is prepared to offer a turbo-generator with dual windings so that a single generator may supply 32 volts d. c. and 117 volts a. c.

The question of an adequate power supply on cabooses is one of the most difficult problems which must be worked out by the mechanical and electrical engineers as radio installations become widespread on this class of equipment. Some progress has been made but considerable difference of opinion exists concerning the best method of accomplishing the results. Storage batteries employing terminal charging only are advocated by some. One or more roads have used small gasoline-driven generators. The presence of gasoline in cabooses is unsatisfactory from a fire hazard standpoint, and some experiments have been made using a small Diesel engine and also an engine operated by butane gas. The question of cost, and



One application of walkie-talkie communication.

the operating characteristics of caboose equipment, i. e., the slow operating speed of some of this equipment and the relatively long periods of non-mobility, make this problem a difficult one.

It appears that the cost of these radio sets at the present time and probably for some time in the future will be about $ 1 000 per unit installed. This does not include the cost of any changes or additions which must be made in the power supply of the unit of rolling stock on which the apparatus is to be installed.

All previous reference to manufacturer has been confined to Bendix since it is the type of apparatus with which we have been working. The Westinghouse Electric Corporation, the General Electric Company, through the General Railway Signal Company, the Farnsworth Radio Corporation, the Television Company, the Aireon Corporation, the Galvin Manufacturing Corporation and Mc Guire Industries, are all conducting tests on different railroads, and they all will be in a position soon, if they are not at present, to provide satisfactory radio apparatus for railroad use.

Possibilities of radar.

Great interest, especially on the part of the lay people, seems to exist in an automatic warning device which might be utilized to avoid collisions. The publicity which has been given to radar and the part that it played in winning the war, has enhanced this interest and made many people ask why radar cannot be used on trains. So far as I know, no serious investigation has been made by anyone concerning this subject but there are certain self-evident facts in respect to the propagation characteristics of radio waves which would seem to indicate that success is dubious. Radio waves are propagated in straight lines and are reflected in straight lines. This principle of reflection is the one on which radar is based. With the extremely crooked right of way which most railroads have, in at least part of their territory, there is no way, so far as I know, to bend these radio beams around curves. There is also the question of large fixed structures adjacent to railroads which would act as reflectors if there was the slightest curvature. There is also the question of reflection from trains on the opposite track in the case of double track, or multiple track operation. All of these factors would seem to indicate that use of a radar warning device involves difficulties which probably will not be overcome. Of course, we have seen so much accomplished that was, at one time, classified as « impossible » that a prediction that this could not be solved would be foolhardy. All I can state is that at present it is not solved, nor does an early solution seem probable.

[385. (09.2]

OBITUARY.

Alfred MANGE,

Honorary General Manager and former President of the Administrative Council of the Orleans Railway Company.
Former President of the Management Committee of the International Railway Union.
Former Member of the Permanent Commission of the International Railway Congress Association.

On the 9th January 1940 died one of the most eminent members of the Permanent Commission of our Association and one of the most striking personalities of the French Railways, Alfred MANGE.

We give below a brief appreciation of his brilliant career taken from the *Bulletin of the International Railway Union :*

Alfred Mange was born in Paris on the 6th February 1864. After studying brilliantly at the « Lycée Charlemagne », he was admitted to the « Ecole Polytechnique » in 1882 and on leaving entered the service of the Orleans Railway Company. As a cadet in 1884 and as an assistant traffic inspector at Headquarters in 1885, his abilities soon brought him to the notice of Mr. HEURTEAU, then Manager of the Company, who appointed him as personal assistant in November 1888.

From 1888 to 1900, the assistance he gave the General Manager was more and more appreciated, and he was rapidly promoted to be Secretary to the Management (1894-1897) and Engineer attached to the General Manager's Office (1897-1900).

In 1900 he was appointed to the Operating Department as Assistant, and as Assistant Manager of the same Department in 1903, becoming the Head in 1908. In November 1914 the Administrative Council appointed him Manager of the Company.

Thus, barely 50 years old, he found himself at the head of the Company with a thorough knowledge of all the component parts of the complicated system which he was able to manage with energy and competence throughout all the difficulties of the 1914-1918 war.

The exceptional services rendered by

Alfred Mange during this period led to him being appointed Commander of the Legion of Honour.

After the war, he presided at the reconstruction of the system and in 1921 he took a very prominent part in the Management Committee of the French Railways.

At this period he caused the electrification programme of the Orleans Company to be drawn up; this project was not limited to substituting electric traction for steam traction on the lines in question, but also included the production and transport by the Company of the power to be consumed on the electrified lines by means of generating equipment and transmission lines.

On the 1st January 1927, the Administrative Council acceded to his request to be allowed to retire and appointed him Honorary General Manager. Wishing to pay him tribute and at the same time profit from his valuable collaboration, the Administrative Council named him Administrator of the Company. He was afterwards nominated President of the Administrative Council.

M. Mange was also on the Administrative Council of the Morocco Railways, and when the International Railway Union was founded in 1922, he was unanimously appointed President of the Management Committee of this Union.

The great competence with which he directed the work of the Union, his courteous and impartial authority, the personal liking all the members of the Union felt for him led to his re-election.

In September 1939, however, his strength underwent a sudden decline, although he managed to carry on with his work until his sudden death on the 9th January 1940. His lengthy career, after a modest beginning, led him to the highest spheres and represents fifty-five years entirely devoted to the service of the railway. His great intelligence, clearness of judgment and poise, his constant concern for justice and equity were combined with a natural distinction of manner and perfect courtesy.

All those who had the privilege of living on intimate terms with him appreciated his greatness of heart and the affectionate delicacy of his relations with his friend and neighbours.

M. Mange was nominated member of the Permanent Commission of our Association in 1922. His collaboration with the work of the Association dates back, however, to the Paris Congress (1889) when he was Reporter on Question XXXIII : « Grouping of Goods ». At the Washington Congress (1905) he was Reporter on Question XIII : « Slow freight rates ». He also took part in the Paris (1900) and Berne (1910) Sessions as the delegate of the Orleans Railway.

He also took an active part in the Rome (1922), London (1925), Madrid (1930), Cairo (1933) and Paris (1937) Sessions, as well as in the enlarged Meetings of the Permanent Commission in Brussels in 1935 and 1939.

Despite the pressure of work, he always took a great interest in the periodic sessions of the Commission which he always endeavoured to attend.

His enlightened mind and courtesy gained him the esteem and sympathy of all his colleagues.

We will keep the best memory of M. Alfred Mange.

The Executive Committee.

Charles de RUFFI de PONTEVÈS,

Former « Inspecteur Général des Mines,
Directeur du Contrôle du Travail des Agents de Chemins de fer au Ministère des Travaux Publics de France ».
Former Member of the Permanent Commission of the International Railway Congress Association.

We have learned with deep regret at the end of the war of the death of our old colleague, M. Charles de RUFFI de PONTEVÈS-GEVAUDAN, former Inspector General of Mines, Director of the Railway Staff Labour Control Department at the Ministry of Public Works of France, at Saint-Cloud on the 2nd April 1944.

Born on June 7th, 1875, at Lilles, M. Charles de Ruffi de Pontevès was a descendant of one of the most famous and oldest families of Dauphiné and Provence. After a brilliant career at the « Collège des Eudistes » at Versailles and the « Lycée Hoche », he entered the Polytechnique in 1893. On leaving the National High School of Mining in 1899, after an educational journey to the United States of America, he held in turn the post of Mining Engineer at Rouen, Engineer in charge of the Technical Operation of the French Nord and State Railway Systems in Paris.

In 1908, he was appointed Assistant to the Director of the Railway Staff Labour Control Department, and in 1911 he was promoted Chief Mining Engineer.

In January 1920 he became Director of the Railway Staff Labour Control Department, in 1924 he was promoted Inspector General of Mines, 2nd class, in 1936 Inspector General of Mines, 1st class, and in September 1939 Vice-President of the General Council of Mines.

His ability, capacity for hard work, the perspicuity of his judgment and his profound knowledge of social questions to which he was predestined by his natural goodness, made him a suitable candidate for certain special posts which the State must perforce reserve for its elite. Thus in 1931 he was nominated President of the Administrative Council of the Miners Pension Fund, and in 1939 President of the Administrative Council of the National Industrial Office for Nitrogenous Products.

After reaching the age limit and retiring on pension in 1941, he continued until the time of his death to act as president of these two important organisations and to take part in the General Mining Council where his enlightened and sure judgment always was respected.

It was however as Head of the Railway Staff Labour Control Department that M. de Ruffi de Pontevès gave proof of his qualities as a great official and negociator. He held this delicate job for nineteen years, from 1920 to 1939, with great liberality and independence of opinion, and an enduring concern for justice and social progress. His work at the head of the Labour Control was very considerable and covered many important questions of an economic and social nature.

His great experience of social questions, his liberal views and profound good sense earned him the job of collaborating in the work of the International Labour Council at Geneva.

M. de Ruffi de Pontevès was elected a member of the Permanent Commission in 1935. His collaboration in the work of the Association dates back to the Rome Session (1922) when he was delegate for the Ministry of Public Works of France. He also took part in the London Session in 1925, and was on the French Local Organizing Commission for the Paris Session in 1937. He also took part in the technical discussions of the enlarged meeting of the Permanent Commission in 1939, and was a devoted and true friend of our Association.

We will always remember our aimable and sympathetic colleague.

The Executive Committee.

[385 (06 .111]

OFFICIAL INFORMATION

ISSUED BY THE

PERMANENT COMMISSION

OF THE

International Railway Congress Association

Meeting of the 6th July 1946 of the Permanent Commission.

The Permanent Commission of the International Railway Congress Association held a meeting on the 6th July last in the Belgian National Railways' Headquarters Offices at Brussels.

* * *

Mr. Henning, *President*, was in the chair.

Opening the meeting in the name of the Belgian Government and of the Belgian National Railways, he welcomed the many personalities present.

The President advised the Meeting of the changes which had occurred in the Permanent Commission since its last meeting and of the results of the steps taken to select the personalities for the mandates still available.

The Meeting then elected the following as Members of the Permanent Commission :

Mr. H. D. Ward Smith, O. B. E., Advisory Engineer to the High Commissioner for the Union of South Africa;

M. M. Malderez, Secrétaire Général du Ministère des Communications de Belgique;

Mr. R. B. White, President of the Baltimore and Ohio Railroad Company;

M. R. Lévi, Directeur du Service Central des Installations fixes et de la Construction à la Société Nationale des Chemins de fer français;

S. E. Hefni Mahmoud Pacha, Ministre des Communications d'Egypte;

M. L. Varga, Président de la Direction des Chemins de fer de l'Etat hongrois;

M. Wagner, Ingénieur en Chef au Ministère des Communications de Pologne, who respectively take the place of Dr. Douglas and Messrs Claeys, Porchez, Ibrahim Doussouky Abasa Pacha, who have resigned (Clause 6 of the Rules and Regulations) and of Messrs Willard, deceased, Laner de Orsova, and Jezierski, of whom no news has been received.

The President then advised the Meeting that Austria had asked for its reaffiliation to the Association. As in the past, this country will be represented on the Permanent Commission by Dr. W. Rauscher, Conseiller Ministériel, Directeur Général Adjoint et Directeur du Service Commercial des Chemins de fer de l'Etat autrichien.

The following Gentlemen were, in accordance with previous practice, made temporary members of the Permanent Commission in their capacity of Members of the Executive Committee of the Swiss Local Organizing Commission of the Lucerne Congress of 1947 :

M. E. BALLINARI, Chef principal d'exploitation des Chemins de fer fédéraux;

M. S. BITTEL, Directeur de l'Office Central Suisse du Tourisme;

M. H. BORN, Secrétaire Général de l'Union d'Entreprises Suisses de Transports;

M. E. BRANGER, Directeur des Chemins de fer Rhétiques, Président de l'Union d'Entreprises Suisses de Transports;

M. P. BUCHLI, Chef de section à l'Office fédéral des Transports;

M. G. DREYER, Chef de section au Secrétariat Général des Chemins de fer fédéraux;

M. W. FISCHER, Chef du Service Commercial des Voyageurs des Chemins de fer fédéraux;

M. P. GUGGISBERG, Directeur du Chemin de fer des Alpes Bernoises Berne-Loetschberg-Simplon;

M. F. HESS, Directeur Général des Postes, Télégraphes et Téléphones;

M. H. HUNZIKER, Directeur de l'Office Central des Transports Internationaux par Chemins de fer;

M. M. LOMBARDI, Chef du Contrôle des Finances et de la Comptabilité générale des Chemins de fer fédéraux;

M. C. LUCCHINI, Directeur du IIe Arrondissement des Chemins de fer fédéraux;

M. A. PERRIG, Directeur de la Société de Navigation du Lac des Quatre Cantons;

M. E. SCHÜTZ, Directeur du Bureau de Tourisme de la Ville de Lucerne;

M. F. STEINER, Chef du service technique de l'Office Fédéral des Transports;

M. F. WANNER, Secrétaire Général des Chemins de fer fédéraux.

— APPENDIX I *gives the list of the actual Members of the Permanent Commission of the Association.*

⁂

M. GHILAIN, *General Secretary*, then gave a report on the organisation of the Lucerne Congress, which will be held from the 23rd to the 28th June 1947 and on the present situation of the preparatory works of the Session in question.

The GENERAL SECRETARY pointed out that all the reporters are now nominated except 2 special reporters and that in order to facilitate the task of the reporters on question II, which must be studied jointly by Sections II and V, he would suggest a 3rd reporter be appointed to make the necessary inquiries concerning Light Railways and Colonial Railways. The Belgian National Light Railways Company agreed to appoint this 3rd reporter and this was approved. (APPENDIX II *gives the list of questions to be discussed and the names of the Reporters.)*

The GENERAL SECRETARY mentioned that 5 out of the 8 lists of questions have already been sent to the affiliated Administrations. The reports will be published in the English and French editions of the *Bulletin*. As the discussions at the Congress will be in English, French and German, the various reports will be published in German but only in the form of special issues to be distributed only to those delegates asking for them. This proposal was adopted by the meeting.

The GENERAL SECRETARY announced that the invitations to nominate the delegates to the Congress will be forwarded very soon. He then gave particulars about the travelling facilities to be granted to the delegates, the preparation of the Vade-Mecum to be sent to the participants together with the membership card, the invitations to the press (swiss and foreign) and the publication in 3 languages of the *Daily Journal of the Session*.

* * *

Mr. MEILE, President of the Executive Committee of the Swiss Local Commission then gave particulars of the steps already taken or to be taken by the Local Organizing Commission. He said that apart from the Executive Committee of Organisation, a *National Honorary Committee* (Comité National d'Honneur) including many of the most eminent personalities of the country has been formed.

The town of Lucerne has been chosen as place of the Session owing to the facilities offered by its *Kongresshaus* for the organisation of the technical and plenary meetings and its interest from the tourist point of view.

He gave also details of the programme scheduled from Monday 23rd June to Saturday 28th June (duration of the Session) and of the different technical visits and excursions arranged for the delegates during and after the Session.

He said that the membership cards would be available from the 10th June to the 15th July 1947 and would be valid as free-passes on the whole system of the Swiss Federal Railways and on the lines of the private Swiss Railways, members of the Association. He mentioned that they intend to organize in the Congress' premises a *Week of the Film* during which the best documentary films in the world on Railways will be exhibited. It was proposed as well to arrange an exhibition of railway models on the occasion of the Centenary of the Swiss railways.

The final programme will be sent to all participants probably in November next.

* * *

The PRESIDENT then advised the meeting that the Executive Committee had decided to submit to the Congress of 1947 a proposition to alter Art. 17 of the Rules and Regulations in order to give the Association a sounder financial situation. He pointed out however that there was no question of an immediate increase of the subscription, the measure considered could not be operative before 1948.

At the request of the CHAIRMAN, the GENERAL SECRETARY stated fully the reasons justifying this proposition, namely to increase the fixed subscription from 100 Gold-francs to 200 Gold-francs and the variable contribution from 1/5 to 1/3 Gold-franc per kilometre.

The GENERAL SECRETARY added that according to the Rules and Regulations (Art. 21), this proposition, after adoption by the Permanent Commission, would be submitted to the Congress of 1947 which will discuss a report to be prepared by a Special Committee on the subject. If the Congress, in turn, agree to the proposition, it can be adopted finally only after a written ballot closed six months after the termination of the session of the Congress (Art. 22 of the Rules and Regulations).

The Permanent Commission adopted unanimously the principle of the modification of Art. 17 of the Rules and Regulations. According to Art. 20 the proposal for this modification will be submitted to the Congress by means of a report of the Permanent Commission.

This report will be despatched to the participants and adherents at least two months before the session.

* * *

The Meeting was after informed of the changes which occurred in the memberships since the previous meeting of the 2nd February last.

The Railway Congress Association at present includes 34 Governments, 11 Organisations and 150 Administrations with a total mileage of 280 000 miles (450 000 km.).

* * *

The Meeting considered finally various points regarding the activities of the Association since the last meeting of the Permanent Commission.

The President,
(s) R. HENNING.

The General Secretary,
(s) P. GHILAIN.

APPENDIX I.

List of Members of the Permanent Commission

OF THE

INTERNATIONAL RAILWAY CONGRESS ASSOCIATION

(July 6th, 1946).

President :

R. **Henning** (2), directeur général de la Société Nationale des Chemins de fer belges ; 19, rue du Beau-Site, Bruxelles.

Vice-Presidents :

Goursat (3), directeur attaché à la Présidence du Conseil d'Administration de la Société Nationale des Chemins de fer français ; 88, rue Saint-Lazare, Paris (IX^{e}) ;

P. **Ghilain** (1), directeur du Service du Matériel de la Société Nationale des Chemins de fer belges ; 19, rue du Beau-Site, Bruxelles.

Members of the Executive Committee :

Dorges (2), inspecteur général des Ponts et Chaussées, directeur général des Chemins de fer et des Transports au Ministère des Travaux publics et des Transports ; 244, boulevard Saint-Germain, Paris ;

Sir Cyril **Hurcomb** (3), director general, Ministry of Transport (Great Britain) ; Berkeley Square House, Berkeley Square, London, W. 1 ;

Sir William V. **Wood** (1), president of the Executive, London Midland and Scottish Railway ; Watford, Herts.

Ex-presidents of session, members ex-officio :

Baron Edouard **de Rothschild,** président du Conseil d'administration de la Compagnie du Chemin de fer du Nord français ; 27, avenue Bosquet, Paris ;

S. E. Ibrahim Fahmy **Kerim** Pacha ; Le Caire.

Members :

E. **Alfonso** (3), président du Conseil d'administration du Réseau National des Chemins de fer espagnols ; Madrid ;

Armand (2), directeur du Service central du Matériel de la Société Nationale des Chemins de fer français ; 20, rue de Rome, Paris ;

Besnard (1), chef de service adjoint au directeur général des Chemins de fer et des Transports, Ministère des Travaux publics et des Transports ; 244, boulevard Saint-Germain, Paris ;

Boutet (1), inspecteur général des Ponts et Chaussées, vice-président du Conseil d'administration de la Société Nationale des Chemins de fer français ; 88, rue Saint-Lazare, Paris (IX^{e}) ;

O. V. **Bulleid** (2) Chief mechanical engineer, Southern Railway ; Waterloo Station, London, S. E. 1 ;

S. E. Mahmoud **Chaker Mohamed** Pacha (2), directeur général des Chemins de fer de l'Etat égyptien ; Le Caire ;

R. **Claudon** (2), inspecteur général des Ponts et Chaussées, membre du Conseil d'administration de la Société Nationale des Chemins de fer français ; 88, rue Saint-Lazare, Paris (IX^{e}) ;

M. W. **Clement** (3), president, Pennsylvania Railroad Company ; Broad Street Station Building, 1617, Pennsylvania Boulevard, Philadelphia, 4, Pa. ;

Colle (3), directeur du Service de l'Exploitation de la Société Nationale des Chemins de fer belges ; 17, rue de Louvain, Bruxelles ;

D^{r} **Cottier** (3), directeur de l'Office fédéral des transports de la Confédération suisse ; Berne ;

R. da **Costa Couvreur** (3), président du Conseil supérieur des Travaux publics au Ministère des Travaux publics et des Communications du Portugal ; Avenida Antonio Serpa, 9-3^{o}, Lisbonne ;

---

(1) Retires at the 14th session.
(2) Retires at the 15th session.
(3) Retires at the 16th session.

G. O. W. P. **Dahlbeck** (1), directeur général et chef des Chemins de fer de l'Etat suédois; Stockholm;

Dargeon (2), directeur du Service central du Mouvement de la Société Nationale des Chemins de fer français; 8, rue de Londres, Paris (IX^e^);

J. **de Aguinaga** (1), sous-directeur général technique du Réseau National des Chemins de fer espagnols; Madrid;

Ing. V. **Dechitch** (1), administrateur principal des Chemins de fer de l'Etat yougoslave; Belgrade;

Delory (2), directeur général adjoint de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Ing. G. **di Raimondo** (3), directeur général des Chemins de fer de l'Etat italien; Rome;

Dorges (already named);

P. **Ghilain** (already named);

Goursat (already named);

R. J. **Harvey** (2), consulting engineer to the Government of New Zealand; 34, Victoria Street, Westminster, London, S. W. 1;

S. E. **Hefni Mahmoud** Pacha (3), Ministre des Communications d'Egypte; Le Caire;

R. **Henning** (already named);

Ing. W. **Hupkes** (3), président des Chemins de fer néerlandais, S. A.; Utrecht;

Sir Cyril **Hurcomb** (already named);

L. **Jacobs** (3), directeur général de la Société Nationale belge des Chemins de fer vicinaux; 14, rue de la Science, Bruxelles;

S. E. Mohamed **Kamal El-Khichin** Bey (2), directeur général-adjoint des Chemins de fer de l'Etat égyptien; Le Caire;

A. **Kriz** (2), ingénieur, commissaire ministériel supérieur au Ministère des Communications de la République tchécoslovaque; Prague;

Dr N. **Laloni** (3), chef du Service Commercial et du Trafic des Chemins de fer de l'Etat italien; Rome;

Le Besnerais (3), président du Comité de gérance de l'Union internationale des Chemins de fer; 10, rue de Prony, Paris (XVII^e^);

Lemaire (1), directeur général de la Société Nationale des Chemins de fer français; 38, rue Saint-Lazare, Paris (IX^e^);

R. **Lévi** (1), directeur du Service central des Installations fixes et de la Construction de la Société Nationale des Chemins de fer français; 42, rue de Châteaudun, Paris;

M. **Malderez** (1), secrétaire général du Ministère des Communications de Belgique; 17A, rue de la Loi, Bruxelles;

A. **Marguerat** (3), directeur des Compagnies de Chemins de fer de Viège à Zermatt, Furka-Oberalp, Gornergrat et Schöllenen; Lausanne;

Ing. F. **Marin** (2), vice-directeur général des Chemins de fer de l'Etat italien; Rome;

Dr **Meile** (1), président de la Direction générale des Chemins de fer fédéraux suisses; Berne;

Ing. E. **Mellini** (3), inspecteur général technique de surveillance à l'Inspectorat général de la motorisation civile et des transports concédés; Rome;

Sir James **Milne** (1), general manager, Great Western Railway; Paddington Station, London, W. 2;

Sir Eustace **Missenden** (3), general manager, Southern Railway; Waterloo Station, London S. E. 1;

Sir Alan **Mount** (1), Chief inspecting officer of Railways, Ministry of Transport; Berkeley Square House, Berkeley Square, London, W. 1;

Sir Charles H. **Newton** (3), chief general manager, London & North Eastern Railway; Dorset Square, Marylebone, London, N. W. 1;

Nolet de Brauwere (2), directeur du Service du personnel de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

J. H. **Nuelle** (2), president, Delaware & Hudson Railroad Corporation; 32, Nassau Street, New York City;

Olivier (3), directeur général-adjoint de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

J. J. **Pelley** (2), president, Association of American Railroads; Transportation Building, Washington 6. D. C.;

Dr W. **Rauscher** (2), conseiller ministériel, directeur général adjoint et directeur du Service

---

(1) Retires at the 14th session.
(2) Retires at the 15th session.
(3) Retires at the 16th session.

Commercial des Chemins de fer de l'Etat autrichien; Elisabethstrasse, 9, Vienne;

J. M. **Rivero de Aguilar** (²), directeur général du Réseau National des Chemins de fer espagnols; Madrid;

E. D. **Terkelsen** (²), directeur général des Chemins de fer de l'Etat danois; 40, Sölvgade, Copenhague, K.;

S. E. Mahmoud **Tewfik Ahmed** Bey (²), sous-secrétaire d'Etat au Ministère des Communications d'Egypte; Le Caire;

J. C. L. **Train** (¹), Chief Engineer, London and North Eastern Railway; King's Cross Station, London, N. 1;

Th. M. B. **van Marle** (²), inspecteur-generaal van het Verkeer, Rijksverkeersinspectie; La Haye;

L. **Varga** (³), président de la Direction des Chemins de fer de l'Etat hongrois; Budapest;

F. Perez **Villamil** (¹), sous-directeur général du Réseau National des Chemins de fer espagnols; Madrid;

Wagner (³), ingénieur en chef au Ministère des Communications de Pologne; Varsovie;

W. K. **Wallace** (²), Chief Engineer, London Midland and Scottish Railway; Watford, Herts;

Dr C. C. **Wang** (¹), representative of Chinese Ministry of Communications; 21, Tothill Street, Westminster, London, S. W. 1;

H. D. **Ward Smith** (²), advisory engineer to the High Commissioner for the Union of South Africa; South Africa House, Trafalgar Square, London, W. C. 2;

R. B. **White** (³), president, Baltimore & Ohio Railroad Company; Baltimore, Md.;

G. **Willaert** (¹), conseiller à la Direction générale de la Société Nationale des Chemins de fer belges; 17, rue de Louvain, Bruxelles;

Sir Leonard **Wilson** (²), Chief commissioner of Railways (India Office); c/o Lloyds Bank Ltd. (G 3 Section), 6, Pall Mall, London, S. W. 1;

Sir William V. **Wood** (already named);

N... (¹) (Argentina);

N... (³) (Argentina);

N... (¹), (Bulgaria);

N... (¹), (Roumania).

Honorary member: U. **Lamalle**, directeur général honoraire de la Société Nationale des Chemins de fer belges, professeur de cours de chemins de fer à l'Université de Louvain; 175, avenue Winston Churchill, Uccle-Bruxelles.

Temporary Members of the Permanent Commission (Members of the Executive Committee of the Swiss Local Organizing Commission of the Lucerne Session 1947).

E. **Ballinari**, chef principal d'exploitation des Chemins de fer fédéraux, Direction générale des Chemins de fer fédéraux; Berne;

S. **Bittel**, directeur de l'Office Central suisse du Tourisme; Bahnhofplatz, 9, Zurich;

H. **Born**, secrétaire général de l'Union d'entreprises suisses de transports; Bundesgasse, 28, Berne;

E. **Branger**, directeur des Chemins de fer rhétiques, président de l'Union d'entreprises suisses de transports; Coire;

P. **Buchli**, chef de section à l'Office fédéral des transports; Berne;

G. **Dreyer**, chef de section au Secrétariat Général des Chemins de fer fédéraux, Direction générale des Chemins de fer fédéraux; Berne;

(¹) Retires at the 14th session.
(²) Retires at the 15th session.
(³) Retires at the 16th session.

W. **Fischer,** chef du service commercial des Voyageurs des Chemins de fer fédéraux, Direction générale des Chemins de fer fédéraux; Berne;

P. **Guggisberg,** directeur du Chemin de fer des Alpes Bernoises Berne-Loetschberg-Simplon; Genfergasse, 11, Berne;

F. **Hess,** directeur général des postes, télégraphes et téléphones; Berne;

H. **Hunziker,** directeur de l'Office Central des Transports Internationaux par Chemins de fer; Monbijoustrasse, 36, Berne;

M. **Lombardi,** chef du contrôle des finances et de la comptabilité générale des Chemins de fer fédéraux, Direction générale des Chemins de fer fédéraux; Berne;

C. **Lucchini,** directeur du II^{e} arrondissement des Chemins de fer fédéraux; Lucerne;

A. **Perrig,** directeur de la Société de navigation du Lac des Quatre Cantons; Lucerne;

E. **Schütz,** directeur du Bureau de Tourisme de la Ville de Lucerne;

F. **Steiner,** chef du service technique de l'Office fédéral des transports; Berne;

F. **Wanner,** secrétaire général des Chemins de fer fédéraux, Direction générale des Chemins de fer fédéraux; Berne.

SECRETARY'S OFFICE : 19, rue du Beau Site, Brussels.

General Secretary : P. **Ghilain** (already named).

XIVth SESSION — LUCERNE (1947)

LIST OF QUESTIONS
for discussion
WITH THE NAMES OF THE REPORTERS.

1st SECTION : WAY AND WORKS.

QUESTION I.

Sleepers.

a) different types;
b) maintenance methods;
c) financial comparison.

Reporters :

English speaking countries :

M. J. C. L. TRAIN, chief engineer, London & North Eastern Railway; King's Cross Station, London N. 1.

Other countries :

M. O. LEDUC, ingénieur en chef au Service Central des Installations fixes et de la Construction de la Société Nationale des Chemins de fer français; 42, rue de Châteaudun, Paris (9e).

Special Reporter :

M. VAN RIJN, ingénieur en chef au Service de la Voie de la Société Nationale des Chemins de fer belges; 21, rue de Louvain, Bruxelles.

2nd SECTION : LOCOMOTIVES AND ROLLING STOCK.

QUESTION II.

Lightening the rolling stock.

Reduction in the weight of rolling stock (passenger and goods) by :

a) choice of the method of construction;
b) use of special steels;
c) use of alloys.

Reporters (*) :

English speaking countries :

Mr. Eyre A. W. TURBETT, assistant chief mechanical engineer, Southern Railway; Eastleigh, Hants (Great Britain).

Other countries :

M. R. GUIGNARD, ingénieur à la Division de la Traction du III^{e} Arrondissement des Chemins de fer fédéraux suisses; Zurich.

Special Reporter :

M. J. DE AGUINAGA, sous-directeur général technique du Réseau National des Chemins de fer espagnols; Madrid.

3rd SECTION : WORKING.

QUESTION III.

As regards passenger traffic, to report on the best policy for the organisation of the train services from the points of view of frequency and composition of trains, to ensure successful transport at the lowest possible cost, whilst giving passengers reasonable facilities.

To consider in turn the cases of steam and electric lines, showing the extent of using steam trains and railcars for the former, and electric motor coaches and electrically driven trains for the latter, on lines with heavy, average, and light traffic, during and outside rush hours of the day.

Reporters :

English speaking countries :

Mr. R. J. HARVEY, consulting engineer to the Government of New Zealand; 34, Victoria Street, Westminster, London, S. W. 1.

(*) *Main railways.* — The same question regarding the Light Railways and Colonial Railways will be the subject of a special report. *(See* SECTION V *hereafter.)*

Other countries :

M. Lorriot, ingénieur en chef, chef de la Division centrale du Mouvement-Voyageurs à la Société Nationale des Chemins de fer français; 8, rue de Londres, Paris, (9^{e}).

Special Reporter :

To be appointed at an early date by the Netherlands Railways.

4th SECTION : GENERAL.

QUESTION IV.

The interest the Railway Compagnies would have in building houses for their staff of all ranks, or in assisting the building of such houses.

Reporters :

English speaking countries :

Mr. A. P. J. Ball, estate manager and rating agent, London Midland and Scottish Railway; Watford, Herts (Great Britain).

Other countries :

M. E. L. Antonucci, inspecteur en chef du Service du Personnel et des Affaires générales, Chemins de fer de l'Etat italien; Rome.

Special Reporter :

To be appointed at an early date by the Portuguese Railways.

5th SECTION : LIGHT RAILWAYS AND COLONIAL RAILWAYS.

Question II (Section 2) applied to *Light Railways and Colonial Railways.*

Reporter :

All countries :

M. W. A. Vrielynck, ingénieur civil, directeur du Service de la Traction et du Matériel de la Société Nationale belge des Chemins de fer vicinaux; 27*bis*, rue de l'Est, Bruxelles.

NEW BOOKS AND PUBLICATIONS.

[**347**. 762]

JOSSERAND (Louis), Honorary Dean of the Faculty of Law at Lyons. Honorary Counsel of the French Supreme Court of Appeal, President of the Institution for the Scientific Study of Communications and Transport. — **Evolution ascendante du contrat de transport au cours du XIX^e et du XX^e siècle.** *(The progressive development of the transport contract during the XIXth and XXth Centuries).* — Booklet (5 1/8 × 7 1/2 inches) of 36 pages. — 1940, Paris, Librairie du Recueil Sirey (*).

In this study the author's object was the characterisation of the original form of the transport contract and a description of its evolution during the XIXth Century to the present time.

Originally there was very little legislation on the subject. For a long time the law lagged very considerably behind the progress due to increased technical knowledge. The great and rapid growth of all kinds of transport led to the formation of a whole code of laws based solely on a few clauses in the Civil Code.

The author stresses the special nature of the transport contract, a contract which is not discussed and built up on each separate occasion, but is prepared by the transporter to a given formula. The consignee or passenger must perforce concur. The reason for this state of affairs is the strong position held by one of the two parties. This has also justified and led to the intervention of the public authorities who have regulated the transport contract and made it an imposed contract.

To become binding after being drawn up, both parties must consent to the contract. In reality it is concluded by the accomplishment of certain given formalities which the author explains by saying that it becomes a formal contract.

In its execution and in its effects, the intervention of outside interests becomes even more marked — that of the legislator in the first place, and then that of the judicial authorities. One striking example of this is the question of responsibility in case of accident.

Finally the transport contract is internationalised owing to the fact that there are international agreements regulating the transport of goods, passengers and luggages, at least as far as the railway is concerned. This has resulted in accentuating the universality of the transport contract, as from one end to the other it comes under the same regulations.

In conclusion the author states that the transport contract has changed its aspect during the last century and especially of recent years, and he expresses the opinion that transport is destined to play a dual part as a field of experience and as a factor of progress in the elaboration of a new judicial order.

(*) Translation of a notice published in the *Bulletin* (French edition) of May 1940.

[**385**. (02]

PLACE (Pierre), former pupil of the Polytechnical School, Paris, First Engineer, Head of the Locomotive Department of the Central Railway Equipment Designing Office (O. C. E. M.). — **Chemins de fer - Agenda Dunod, 1940** *(Railways - Dunod Pocket Book)* (59th *edition*). — One volume (4 × 6 inches) of CXLIV-416 pages with 94 figures and one plate — Dunod, Publisher, 92, rue Bonaparte, Paris (VI^e) (*).

The 59th edition of the Dunod Railway Pocket Book (1940) like its predecessors is a first class up-to-date encyclopedia on the permanent way (estimation of the probable traffic, cost of construction and operation, administrative formalities, design of the track, locomotive watering stations, mains, etc.); on traction (train resistance, power of locomotives, loads, steam locomotives, railcars, electric traction and ferryboats); on rolling stock (train parts, different types of passenger and goods stock, brakes, lighting and heating, etc.); and finally on the operation (traffic, safety devices, rates, receipts and expenditures, taxes, statistical information).

The 1940-edition includes in particular the following studies :

French locomotives with a pressure of 20 h.p.z and above;

New types of locomotives : locomotive with Velox boiler, Bugatti steam locomotive, Dabeg locomotive;

Railcars : small average-sized and large railcars.

List of technical specifications, together with the date on which they were last revised.

(*) Translation of a notice published in the *Bulletin* (French edition) of May 1940.

CORRIGENDA.

to article : **Pacific locomotives on the Southern Railway,**

By O. V. S. BULLEID.

Bulletin of June 1946

Page 113, 1st column, 33rd line, instead of : « 3/4 in. centres »,
read : « 3 1/4 in. centres ».

Page 114, 2nd column, 26th line, instead of : « sq. ft. »,
read : « sq. in. ».

MONTHLY BIBLIOGRAPHY OF RAILWAYS(1)

PUBLISHED UNDER THE SUPERVISION OF

P. GHILAIN,

General Secretary of the Permanent Commission of the International Railway Congress Association.

(AUGUST 1946.)

[016. 385. (02]

I. — BOOKS.

In French.

1943 665 .882

EEL (C.-F.).

a pratique de la soudure autogène (3e édition).

Bâle, édité par la Société suisse de l'Acétylène. 1 vol. × 20 cm.) de 386 pages et 388 figures. (Prix : relié, r. suisses.)

1945 624. (06

moires de l'Association Internationale des Ponts et Charpentes, Septième volume : 1943/44.

urich, édité par A. G. Gebr. Leeman & Co. 1 volume × 24 cm.) de 387 pages.

1946 62. (01 & 691

REAU (H.).

alcul du ciment armé à la flexion. Tables des lois

$$, \gamma, \mu = \frac{M E}{bh^2}.$$

aris (7e), en vente chez l'auteur, 4, avenue de Breil. 2 brochures (21 × 31 cm.) de 44 et 36 pages. ix : 130 et 120 fr. français.)

945 69. (02

CHTERGAL (A.).

genda du bâtiment.

ruxelles, A. De Boeck, éditeur. 1 volume cartonné × 17 cm.) de 486 pages et 513 figures. (Prix : fr. belges.)

945 656 .235

ILLARD (A.).

es Tarifs de Chemins de fer en matière de marchanes.

ausanne, Edition F. Roth et Cie. 1 vol. de 320 pages, gures, 19 graphiques & 27 tableaux.

946 385. (08 (.493)

CIETE NATIONALE DES CHEMINS DE FER VICINAUX (Belgique).

apports présentés par le Conseil d'administration et le Comité de Surveillance, 61e exercice social. iée 1945.

ruxelles, Imprimerie H. & M. Schaumans, 41, parvis it-Gilles. 1 volume (23 × 30 cm.) de 130 pages, avec arte hors texte.

In German.

1942 656 .256 .3 (.494)

Dr. K. OEHLER-GUTZWILLER.

Der automatische Streckenblock mit Achszählung.

Zürich, Sonderdruck aus der « Schweizerischen Bauzeitung », Band 120, Nr. 14, 1942, (23 × 31 Zentim.). 8 Seiten mit Abbildungen.

1946 656 (.494)

MEYER (Dr. H. R.).

Die organische Verkehrsordnung. Ein Versuch zur Planung der Schweizerischen Verkehrswirtschaft.

Bern, im Selbstverlag des Verfassers. (Preis : 10 Schw. Fr.)

In English.

1946 537

A chronological history of electrical development.

Published by the National Electrical Manufacturers Association, New York 17, N. Y., 154 pages (6 1/4 × 9 1/4 in.). Bound in fabrikoid. (Price : $ 2.00.)

1946 385. (09 .3 (.42)

BELL (R.).

History of the British Railways during the war 1939-1945.

London, 1946 : « The Railway Gazette », 33, Tothill Street, Westminster, S. W. 1 (9 × 6 in.). 291 pages. (Price : 25 sh.)

1946 625 .42 (.42)

Building the Inner Circle Railway (London).

London, « The Railway Gazette », 33, Tothill Street, Westminster, S. W. 1. (Price : 2 sh. 6 d.)

1946 656. (06 (.4)

EUROPEAN CENTRAL INLAND TRANSPORT ORGANISATION.

The transport situation in Europe.

No. 6, March, 1946. A publication of 54 pages, published by E. C. I. T. O., 40, Grosvenor Square, London, W. 1. (Price : 5 sh.)

---

1) The numbers placed over the title of each book are those of the decimal classification proposed by the Railway Congress conly with the Office Bibliographique International, of Brussels. (See « Bibliographical Decimal Classification as applied to Railway ice », by L. WEISSENBRUCH, in the number for November 1897, of the *Bulletin of the International Railway Congress*, p. 1509).

1946 313 .385 (.7)

Freight Progress Annual Number of Railway Age (May 18, 1946, number 20).

A series of 11 articles reviewing freight progress in North America (152 pages with many illustrations, diagrams and tabulations).

Published by the Simmons Boardman Publishing Corporation, 30, Church Street, New York (N. Y.). (Price : one dollar a copy.)

1946 388 (.42)

Improving London's transport.

A publication of « The Railway Gazette » describing the new works schemes of the L. P. T. B., the L. N. E. R. and the G. W. R.

London, « The Railway Gazette », 33, Tothill Street, Westminster, S. W. 1. 62 diagrams and maps, 97 photographs and folding plate. (Price : 5 sh.)

1944 621 .13 (02 & 621 .431 .72 (02

JOHNSON (Ralph. P.).

The steam locomotive : its theory, operation and economics, including comparisons with Diesel-electric locomotives. 2nd edition.

New York, Simmons Boardman Publishing Corporation. 564 pages, 104 fig., 73 tables, 3 appendices and 4 folding plates. (Price : $ 5.00.)

1946 656

LEE (Charles E.).

Passenger class distinctions.

London, « The Railway Gazette », 33, Tothill Str
Westminster, S. W. 1. (Price : 6 sh.)

1945 62

Machine tool guide, by T. C. PLUMRIDGE in coll
ration with R. W. BOYD, Jr. and James Mc K
NEY, Jr.

Published by The American Technical Society,
cago. 630 pages (8 × 11 in.). Illustrated. (Boun
cloth. Price : $ 7.50.)

1946 38

Railway Inspection.

A booklet (5 1/2 × 8 in.), of 24 pages, published
« The Railway Gazette », 33, Tothill Street, Lon
S. W. 1 .(Price : 1 sh.)

1945 62. (01 &

SMITH (D. M.).

Collected papers on metallurgical analysis by spectrograph.

London, British Non-Ferrous Metals Research A
ciation. A volume of 162 pages and 58 fig. (Pr
21 sh.)

[016. 385. (05]

II. — PERIODICALS.

In French.

Annales des Travaux publics de Belgique. (Bruxelles.)

1943 624 .2

Annales des Travaux publics de Belgique, août, p. 393 ; octobre, p. 521 ; décembre, p. 677.

VERLY (F.). — Aspect du problème de la **vibration des ponts-routes métalliques.** (27 000 mots & fig.)

1943 624 .2

Annales des Travaux publics de Belgique, oct., p. 513.

DESCANS (L.). — Le tracé des lignes d'influence des **poutres** hyperstatiques à moment d'inertie variable. (1 600 mots & fig.)

1944 62. (01 & 691

Annales des Travaux publics de Belgique, avril, p. 101.

MAGNEL (G.). — Le dosage scientifique des **bétons.** (12 000 mots, tableaux & fig.)

1944 62. (01 & 691

Annales des Travaux publics de Belgique, juin, p. 199 ; août, p. 443 ; octobre, p. 563 ; décembre, p. 711.

DUTRON (R.). — **Vibration du béton et du béton armé.** (40 000 mots, tableaux & fig.)

1944 624 .2 & 721 .9

Annales des Travaux publics de Belgique, juin, p. 265.

KARTSEFF (B.-S.). — Calcul simplifié du **béton précontraint.** (8 000 mots & fig.)

1944 72

Annales des Travaux publics de Belgique, juin, p.

DE BEER (E.-E.). — Tassements dus au **rabatte
de la nappe phréatique.** (10 000 mots & fig.)

1944 624 .32 (.

Annales des Travaux publics de Belgique, déc., p.

CLAEYS (E.) et GORIS (L.-J.). — Le nou
pont-route de Kampenhout sur le canal de Louva
Malines. (4 000 mots & fig.)

Bulletin de la Société des Ingénieurs civ de France. (Paris.)

1945 62.

Bulletin de la Soc. des Ing. Civils de France (mémo
fasc. nos 1 à 3, janvier-février-mars, p. 65.

KAMMERER (A.). — Quelques applications d
photoélasticimétrie. (5 000 mots & fig.)

1945 62. (01 & 6

Bulletin de la Soc. des Ing. Civils de France (mémo
fasc. nos 1 à 3, janvier-février-mars, p. 100.

VIALLE (J.-M.). — Contribution à l'étude de
fluence du **traitement thermique** sur la limite élas
des aciers à la traction. (6 000 mots, tableaux & fi

1945 385

Bulletin de la Soc. des Ing. Civils de France (mémo
fasc. nos 4 et 5, p. 153.

BOUTET. — La **reconstruction** de l'outillage nat
Les programmes. (8 000 mots.)

1945 **62. (01**
Bulletin de la Soc. des Ing. Civils de France (mémoires), fasc. nos 4 et 5, p. 178.
DURIEZ. — Méthodes scientifiques de laboratoire pour la conception, la vérification et l'**auscultation des ouvrages.** (6 000 mots & fig.)

1945 **721 .1**
Bulletin de la Soc. des Ing. Civils de France (mémoires), fasc. nos 4 et 5, p. 202.
BUISSON. — Essais sur les **sols.** (3 000 mots.)

Bulletin des transports internationaux par chemins de fer. (Berne.)

1942 **347 .763 .4 (.469)**
Bull. des transp. intern. par ch. de fer, février, p. 47.
EGER (G.). — Considérations sur la **législation ferroviaire** du Portugal. (4 500 mots.)

1942 **385 .63**
Bull. des transp. intern. par ch. de fer, février, p. 60.
HUBER (K.-A.). — Une modification de l'article 28 de la **C. I. M. ?** (2 200 mots.)

1942 **347 .763 .4 (.481)**
Bull. des transp. intern. par ch. de fer, février (annexe), p. 20; mars (annexe), p. 33; avril (annexe), p. 49; mai (annexe), p. 65.
Conditions de transport (règlement de transport) des Chemins de fer de l'Etat de Norvège du 1er juillet 1935. (18 000 mots.)

1942 **385 .62 & 385 .63**
Bull. des transp. intern. par ch. de fer, mars, p. 85.
SCHMID (E.-E.).— La conformation future de la **C. I. V.** et de la **C. I. M.** (3 000 mots.)

1942 **385 .63**
Bull. des transp. intern. par ch. de fer, avril, p. 125.
MANCINELLI (E. Narni). — L'erreur dans l'**application du tarif** ou dans le **calcul des frais de transport,** d'après les « Conditions et tarifs italiens ». (3 500 mots.)

1942 **385. (061 (.494) & 385 .6 (.494)**
Bull. des transp. intern. par ch. de fer, mai, p. 183.
Extrait du rapport de gestion de la quarante-neuvième année (1941) de l'**Office central des Transports internationaux par chemins de fer.** (1 200 mots.)

1942 **385. (.3)**
Bull. des transp. intern. par ch. de fer, mai, p. 187.
Les **Chemins de fer du monde.** (1 000 mots & 2 tabl.)

1942 **385 .113 (.481)**
Bull. des transp. intern. par ch. de fer, mai, p. 192.
Les **résultats de l'exploitation** des Chemins de fer norvégiens pour l'exercice 1939/40. (1 200 mots.)

1942 **385 .113 (.485)**
Bull. des transp. intern. par ch. de fer, juin, p. 241.
La gestion des **Chemins de fer suédois** en 1940. (1 100 mots.)

1942 **656 .223 .2**
Bull. des transp. intern. par ch. de fer, juillet, p. 253.
WEBER (K.-E.). — Le contrat d'immatriculation des **wagons de particuliers** et la jurisprudence. (2 400 mots.)

1942 **656 .225 & 656 .261**
Bull. des transp. intern. par ch. de fer, juillet, p. 281.
Les transports effectués au moyen de **cadres** (containers). (2 000 mots.)

1942 **313 .385 (.494)**
Bull. des transp. intern. par ch. de fer, juillet, p. 294.
Les **Chemins de fer fédéraux suisses** en 1941. (Tabl.)

1942 **385 .62 & 385 .63**
Bull. des transp intern. par ch. de fer, août, p. 301.
Longueurs kilométriques des lignes auxquelles s'appliquent la **C. I. M.** et la **C. I. V.** (800 mots & tableaux.)

1942 **385 .6**
Bull. des transp. intern. par ch. de fer, août, p. 306.
Considérations sur la transformation des **Conventions.** (7 000 mots.)

1942 **385 .113 (.439)**
Bull. des transp. intern. par ch. de fer, août, p. 336.
Les prestations de l'exploitation et les **résultats de la gestion** des Chemins de fer royaux de l'Etat hongrois pendant l'exercice 1940. (2 200 mots.)

1942 **385 .62 & 385 .63**
Bull. des transp. intern. par ch. de fer, sept., p. 356.
NOE (G.). — La mise à exécution des **Conventions ferroviaires internationales** issues des Conférences de révision. (4 000 mots.)

1942 **385 .113 (.496 + .56**
Bull. des transp. intern. par ch. de fer, sept., p. 386.
Les **résultats de l'exploitation** des Chemins de fer de l'Etat pour les exercices 1939/40 et 1940/41. (400 mots & tableaux.)

1942 **385 .63**
Bull. des transp. intern. par ch. de fer, octobre, p. 398.
EGER (G.). — Documents de transport. Le droit portugais concernant **la perte et l'avarie des marchandises.** (3 500 mots.)

Bulletin technique de la Suisse romande. (Lausanne.)

1944 **621 .33 (.494)**
Bull. techn. de la Suisse romande, no 8, 15 avril, p. 93; no 10, 13 mai, p. 121.
ZEHNDER (R.). — Les **améliorations techniques** du Chemin de fer Montreux-Oberland bernois. (13 000 mots & fig.)

1944 **691 & 721 .9**
Bull. techn. de la Suisse romande, no 12, 10 juin, p. 149.
Béton et **béton précontraint.** Quelques exemples d'ouvrages réalisés en béton précontraint. (3 000 mots & fig.)

1944 **669**
Bull. techn. de la Suisse romande, no 13, 24 juin, p. 161.
LANG (A.). — **Trempe** superficielle à l'autogène. (2 600 mots & fig.)

1944 **625 .41**
Bull. techn. de la Suisse romande, no 15, 22 juil., p. 191.
Economie dans la construction des **téléfériques** à va-et-vient pour transport de personnes. (1 000 mots & fig.)

Génie Civil. (Paris.)

1942 **62. (01 & 669**

Génie Civil, nº 3075-3076, 17-24 janvier, p. 30; nº 3077-3078, 31 janvier-7 février, p. 53.

GUILLET (L.). — Les principaux **produits métallurgiques de remplacement.** (7 800 mots, 3 tableaux & fig.)

1942 **621 .392 & 669**

Génie Civil, nº 3075-3076, 17-24 janvier, p. 33.

BIAIS (R.). — Les économies de matières ferreuses et d'énergie procurées par la soudure en construction **ferroviaire.** (3 000 mots & fig.)

1942 **625 .142 .2**

Génie Civil, nº 3079-3080, 14-21 février, p. 80.

La consolidation par frettage des **traverses en bois** pour chemins de fer. (700 mots & fig.)

1942 **385. (09 .1 (.66)**

Génie Civil, nº 3081-3082, 28 février-7 mars, p. 95.

CASLOT (Ch.). — Le **chemin de fer Méditerranée-Niger.** Comparaison avec les grands chemins de fer transcontinentaux et coloniaux. (3 500 mots & 2 cartes.)

1942 **624 .52 (.44)**

Génie Civil, nº 3081-3082, 28 février-7 mars, p. 102.

Les **ponts cantilever en béton armé** de l'autoroute de l'Ouest, de la Région parisienne. (700 mots & fig.)

1942 **669 & 691**

Génie Civil, nº 3083-3084, 14-21 mars, p. 113.

UDE (H.). — La réalisation des **économies de matériaux.** (5 000 mots.)

1942 **662**

Génie Civil, nº 3083-3084, 14-21 mars, p. 117.

Le programme de fabrication des futurs **carburants de remplacement** et l'avenir de leur industrie. (3 000 mots.)

1942 **662**

Génie Civil, nº 3083-3084, 14-21 mars, p. 119.

L'emploi d'**agglomérés mixtes pour gazogènes.** (1 300 mots.)

1942 **625 .13**

Génie Civil, nº 3085, avril, p. 139.

Appareil enregistreur pour mesurer les **dimensions des souterrains.** (1 100 mots & fig.)

1942 **62. (01 & 721 .1**

Génie Civil, nº 3086, mai, p. 157.

FERRANDON (J.). — Extension de la formule de Froehlich à des **sols** de courbe intrinsèque quelconque. (1 600 mots & fig.)

1942 **621 & 669**

Génie Civil, nº 3087, juin, p. 176.

DUMAS (J.). — L'**allègement** dans les constructions. (4 200 mots.)

1942 **624 .63 (.44)**

Génie Civil, nº 3088, 1er juillet, p. 189.

COSMI (P.). — Le nouveau **pont** de Joinville, sur la Marne, près de Paris. (5 000 mots & fig.)

1942 **621 .89**

Génie Civil, nº 3088, 1er juillet, p. 194.

BRILLIE (H.). — La pénurie de **lubrifiants.** Problèmes de mécanique à résoudre. (3 000 mots.)

1942 **62. (01 (.44) & 625 .252 (.4**

Génie Civil, nº 3088, 1er juillet, p. 198.

Nouvelle machine pour l'**essai des fontes,** de la Socié
Nationale des Chemins de fer français. (500 mots & fig

1942 **62. (01 & 721**

Génie Civil, nº 3089, 15 juillet, p. 208.

PIGEAUD (G.). — Formules de **battage des pieu**
(2 500 mots.)

1942 **6**

Génie Civil, nº 3090, 1er août, p. 220.

BERTHELOT (Ch.). — Technique et industrie
carburants de remplacement. (2 500 mots.)

1942 **385. (01 (.6**

Génie Civil, nº 3091, 15 août, p. 229.

TEISSIER (P.). — Le **Chemin de fer Méditerran**
Niger et l'exploitation des houillères de Djérada et
Kénadza. (2 500 mots & fig.)

1942 **388 (.4**

Génie Civil, nº 3091, 15 août, p. 237.

L'exploitation, par la Compagnie du Chemin de
Métropolitain de Paris, des **lignes de transports en co**
mun de surface de la Région parisienne. (1 000 mots.)

L'Industrie des voies ferrées et des transports automobiles. (Paris.)

1946 **625 .4 (.**

L'Ind. des voies ferrées et des transp. autom., juin, p.
REBUFFEL (A.) & RUMILLY (A.). — Les **télép**
riques pour voyageurs en France. (2 000 mots, table
& fig.)

Mémoires de l'Association des Ingénieurs sortis de l'Ecole de Liége. (Liége.)

1943 **621**

Mémoires de l'Association des Ingénieurs sortis de l'E
de Liége, nº II, p. 28.

DANZE (J.). — Étude thermodynamique de la **c**
dière. (6 400 mots & fig.)

1943 **621**

Mémoires de l'Association des Ingénieurs sortis de l'E
de Liége, nº II, p. 58.

BIDLOT (R.). — **Chaudières** à très haute pressio
chaudières spéciales. (6 500 mots & fig.)

1943 **621**

Mémoires de l'Association des Ingénieurs sortis de l'E
de Liége, nº II, p. 81.

VINÇOTTE (R.). — Quelques données sur les r
tats pratiques des méthodes actuelles de **traitemen**
l'eau des chaudières. (13 000 mots, 6 tableaux & fig.)

1943 **62. (01 &**

Mémoires de l'Association des Ingénieurs sortis de l'E
de Liége, nº IV, p. 155.

MORAY. — Les possibilités d'**études en métall**
au moyen des rayons X. (4 500 mots, tableaux &

1943 **62. (01 & 621 .392**
émoires de l'Association des Ingénieurs sortis de l'Ecole de Liége, nº IV, p .163.
LOUIS (H.). — Résultats de la **radiographie** dans la étection des défauts macroscopiques des **soudures.** 000 mots & fig.)

1943 **662**
émoires de l'Association des Ingénieurs sortis de l'Ecole de Liége, nº VI, p. 240.
DE RIDDER (R.). — Les qualités requises d'un bon **arbon pour gazogène.** (7 000 mots, 5 tableaux & fig.)

1943 **621 .116**
émoires de l'Association des Ingénieurs sortis de l'Ecole de Liége, nº VI, p. 248.
BATTA (G.) & LECLERC (E.). — Sur la formation s **incrustations en chaudière.** (2 000 mots.)

L'Ossature métallique. (Bruxelles.)

1946 **624**
'Ossature métallique, janvier-février, p. 1.
STEINMAN (D.-B.). — L'esthétique des **ponts métal- ques.** (2 500 mots & fig.)

1946 **621 .392 (.44) & 624 .32 (.44)**
'Ossature métallique, mars-avril, p. 49.
Le nouveau **pont** de Saint-Cloud sur la Seine. (3 000 ots & fig.)

1946 **625 .232 (.460)**
'Ossature métallique, mars-avril, p. 61.
Les **nouvelles voitures métalliques** des Chemins de fer pagnols. (1 500 mots & fig.)

1946 **656 .211 .5 (.42)**
'Ossature métallique, mars-avril, p. 78.
Abris de quai préfabriqués en Angleterre. (800 mots fig.)

1946 **624 .2 (.493)**
'Ossature métallique, mars-avril, p. 83.
Un nouveau système belge de **poutres pour ponts** Système Robert et Musette). (3 500 mots & fig.)

Revue générale des chemins de fer. (Paris.)

1942 **385 .517 .1 (.44)**
evue générale des chemins de fer, nº 5, septembre-octobre, p. 245.
WALTISPURGER. — Le **régime des retraites** de la ociété Nationale des Chemins de fer français. (5 500 ots & tableaux.)

1942 **624 .63 (.44) & 625 .13 (.44)**
evue générale des chemins de fer, nº 5, septembre-octobre, p. 251.
MUCHERIE (L.). — La **reconstruction** du **pont** de aversine. (2 300 mots & fig.)

1942 **624 .32 (.44) & 625 .13 (.44)**
evue générale des chemins de fer, nº 5, septembre-octobre, p. 255.
La **reconstruction** du **pont** Eiffel (Paris-Mantes). (4 000 ots & fig.)

1942 **385 (071 (.44) & 625 .245 (.44)**
Revue générale des chemins de fer, nº 5, septembre-octobre, p. 262.
BECQ. — Le **cinéma** au chemin de fer (wagons-cinémas). (1 000 mots & fig.)

1942 **656**
Revue générale des chemins de fer, nº 6, novembre-décembre, p. 269.
GUIBERT. — Le **problème rail-route** et l'impossible liberté des transports. (21 000 mots.)

1942 **621 .392 (.44) & 625 .13 (.44)**
Revue générale des chemins de fer, nº 6, novembre-décembre, p. 285.
CAYLA. — Réparation par **soudure électrique** d'un **pont** sur la Vire. (2 000 mots & fig.)

1943 **62 (0 (.44), 621 .139 (.44) & 625 .27 (.44)**
Revue générale des chemins de fer, nº 1, janvier-février, p. 1.
ARSON. — Les **économies de matières** dans les services du Matériel et de la Traction de la S. N. C. F. (6 500 mots & fig.)

1943 **624 .63 (.44) & 625 .13 (.44)**
Revue générale des chemins de fer, nº 1, janvier-février, p. 11.
ADINE. — La reconstruction du **viaduc** de Poix sur la vallée du Fay. (2 800 mots & fig.)

1943 **656 .259 (.44)**
Revue générale des chemins de fer, nº 1, janvier-février, p. 18.
DUBOIS (C.) & JOLFRE. — Un dispositif de **signaux acoustiques** pour l'arrêt des trains en cas d'incident de route et notamment de chauffage de boîtes d'essieux. (1 200 mots & fig.)

1943 **621 .431 .72 & 662**
Revue générale des chemins de fer, nº 1, janvier-février, p. 20.
Comment économiser les **matières premières.** (Vue d'ensemble sur le rendement énergétique global de la transformation de matières premières en carburants (charbon, bois). (1 100 mots. 1 tabl.)

1943 **625 .14 (01 (.73) & 625 .215 (.73)**
Revue générale des chemins de fer, nº 1, janvier-février, p. 22.
Essais de **tenue de la voie** au passage de locomotives électriques (Electric Ry. Traction, 12/11/37). (1 200 mots.)

1943 **621 .13 (.43) & 623 (.43)**
Revue générale des chemins de fer, nº 1, janvier-février, p. 23.
Les essais de la **locomotive de guerre** allemande (Extrait de la « Deutsche Allgemeine Zeitung » du 13 octobre 1942). (900 mots & fig.)

Science et Vie. (Paris.)

1946 **625 .17**
Science et Vie, avril, p. 167.
LALLEMENT. — Les méthodes modernes d'**entretien et de renouvellement des voies ferrées.** (2 500 mots & fig.)

Société Royale belge des Ingénieurs et des Industriels. (Bruxelles.)

1941 **624 .63 (.675)**
Société royale belge des Ingénieurs et des Industriels, nº 1, p. 5.
COPPÉE (R.). — Les **appareils d'appuis, en béton fretté,** du pont sur le fleuve Congo-Lualaba à Kongolo. Essais sur modèles réduits. (6 500 mots, tableaux & fig.)

La Technique moderne. (Paris.)

1943 **621 .335 (.494)**
La Technique moderne, nos 9 et 10, 1er et 15 mai, p. 71.
Modernisation d'une locomotive à courant monophasé de la ligne du Loetschberg (Suisse). (1 600 mots & fig.)

1943 **62 (01 & 669 .1**
La Technique moderne, nos 11 et 12, 1er et 15 juin, p. 79.
SCHMIDT (R.). — La **radiographie** des moulages d'acier. (7 000 mots & fig.)

1943 **625 .2 : 625 .62 (.43)**
La Technique moderne, nos 13 et 14, 1er et 15 juillet, p. 103.
La normalisation des **voitures de tramways** en Allemagne. (4 000 mots, tableaux & fig.)

1944 **621 .392**
La Technique moderne, nos 15 et 16, 1er et 15 août, p. 111.
SALELLES (R.). — **Machines à souder** à l'arc électrique. (6 000 mots & fig.)

1945 **623 (.44) & 624 (.44)**
La Technique moderne, nos 9, 10, 11 et 12, 1er et 15 mai, 1er et 15 juin, p. 76.
VALETTE. — **Reconstruction des ponts** de la S. N. C. F. (3 500 mots & fig.)

1946 **621 .9**
La Technique moderne, nos 9 et 10, 1er et 15 mai, p. 81.
GORDON (J.). — Les **nouveautés industrielles** en 1946 **(machines-outils).** (12 000 mots & fig.)

In German.

Archiv für Eisenbahnwesen. (Berlin.)

1941 **385 .15 (.4)**
Archiv für Eisenbahnwesen, September/Oktober, S. 705.
CONRAD (O.). — Der **Autonomiegedanke** bei europäischen Staatseisenbahnen. (75 000 Wörter.)

1941 **385. (09. 3 (.43)**
Archiv für Eisenbahnwesen, September/Oktober, S. 855.
Dr. KITTEL. — Aktenstücke zur **Vorgeschichte** der Reichsbahn. (18 000 Wörter.)

1941 **385. (09. 3 (.436)**
Archiv für Eisenbahnwesen, November/Dezember, S. 929.
FEILER (K.). — Die Österreichische **Südbahn.** (32 000 Wörter & Karte.)

1941 **385. (09 (.45**
Archiv für Eisenbahnwesen, November/Dezember, S. 995
WERNEKKE. — Die **italienischen Staatseisenbahne** unter der Herrschaft des Faschismus. (10 000 Wörter.

1941 656. 23 (
Archiv für Eisenbahnwesen, Novemb./Dezemb., S. 1071
WEIRAUCH (W.). — Zur Frage des **Tarifzwangs** (5 000 Wörter.)

1942 **385 .4 (.460**
Archiv für Eisenbahnwesen, Jan./Febr., S. 53 & 133
WERNEKKE. — **Neuordnung** des spanischen Eisen bahnwesens. (5 600 Wörter.)

1942 **385 .113 (.492**
Archiv für Eisenbahnwesen, Januar/Februar. S. 69.
OVERMANN. — Die **Niederländischen Eisenbahne** (N. S.) im Jahre 1940. (4 400 Wörter & Tabellen.)

Der Bahn-Ingenieur. (Berlin.)

1940 **621 .137 & 621 .13**
Der Bahn-Ingenieur, Nr. 38, 22. September, S. 473.
KOCH (K.). — Praktische Winke für störungsfreie und wirtschaftlichen **Lokomotivbetrieb.** (4 000 Wörte & Abb.)

1940 **625 .144 .**
Der Bahn-Ingenieur, Nr. 38, 22. September, S. 478.
KERLER. — **Ausgleichschienen im Übergangsboge** (1 500 Wörter, Tabellen & Abb.)

1940 **625 .144 .**
Der Bahn-Ingenieur, Nr. 38, 22. September, S. 481.
SCHRAMM (G.). — Die Ermittlung der **Ausgleich schienen** im Gleisbogen. (1 100 Wörter & Abb.)

1940 **621 .135 .**
Der Bahn-Ingenieur, Nr. 40, 6. Oktober, S. 497.
OTTERSBACH. — Brüche und Verschleisserscheinu gen an **Federspannschrauben** der Lokomotiven und Te der. (2 100 Wörter & Abb.)

1940 **625 .122 & 625 .1**
Der Bahn-Ingenieur, No. 41, 13. Oktober, S. 510.
WEBER (H.). — Das chemische **Bodenverfestigung und Abdichtungsverfahren.** (1 300 Wörter & Abb.)

1940 **625 .212 (.4**
Der Bahn-Ingenieur, Nr. 41, 13. Oktober, S. 517.
Vorläufige Richtlinien für die **Wiederbefestigung los Wagenradreifen** durch Blechringbeilagen. (850 Wört & Abb.)

1940 **656 .2**
Der Bahn-Ingenieur, Nr. 42, 20. Oktober, S. 521.
MÜLLER (Dr. Ing. W.). — Einführung in die **Fah dynamik.** (7 500 Wörter & Abb.)

1940 **625 .144**
Der Bahn-Ingenieur, Nr. 43, 27. Oktober, S. 533.
GEISSBAUER. — Kraftbetriebene **Oberbaugerät** (5 900 Wörter & Abb.)

Elektrische Bahnen. (Berlin.)

1941 621 .33
ktrische Bahnen, Heft 12, Dezember, S. 233.
OTHER (H.). — Verwendung von Kenngrössen aus
Betriebsstatistik für den allgemeinen **Entwurf elek=**
cher Bahnen. Eine Untersuchung über die Zusammen-
ige von Zahl, Leistung und Arbeitsverbrauch der
iftwerke, Unterwerke und Triebfahrzeuge. (16 000
rter, Tafeln & Zusammenstellungen & Bildern.)

1942 621 .33
ktrische Bahnen, Heft 1, Januar, S. 1.
VECHMANN (W.). — **Wechselstrom=Grossbahnen**
Fernschnellverkehr. (6 000 Wörter & Abb.)

1942 621 .333
ktrische Bahnen, Heft 1, Januar, S. 8.
TEINBAUER (W.). — Das **dynamoelektrische Prin=**
und die elektrischen Bahnen. (3 500 Wörter & Abb.)

942 621 .332
ktrische Bahnen, Heft 1, Januar, S. 17.
ROSPERI (L.) & TRINCHIERI (A.). — **Stahlspa=**
de Maste für Hochspannungsleitungen der Italieni-
en Staatsbahnen. (1 500 Wörter & Abb.)

942 621 .135 .4 & 625 .215
ktrische Bahnen, Heft 2, Februar, S. 21; Heft 5,
Mai, S. 91.
EUMANN. — Zum **Bogenlauf** von Gelenkfahrzeu-
. (15 000 Wörter, Tafeln & Abb.)

942 621 .337
ktrische Bahnen, Heft 2, Februar, S. 37.
UCHHOLD (Th.). — Über die **automatische Rege=**
g von feinstufig arbeitenden Fahrzeugsteuerungen.
00 Wörter & Abb.)

Glasers Annalen. (Berlin.)

941 656 .256 .3
sers Annalen, Heft 5, 1. März, S. 105.
LÄSEL. — Automatik im **Eisenbahn=Signalwesen.**
00 Wörter.)

941 621 .87 (.43) & 621 .138 .2 (.43)
sers Annalen, Heft 5, 1. März, S. 106.
OLTSCHMIT. — Die **Hebezeuge** im Eisenbahnbe-
b. (4 000 Wörter & Abb.)

941 691 (.43)
sers Annalen, Heft 6, 15. März, S. 117.
IEGMANN (H.). — Austauschstoffe in der **Dich=**
gsindustrie. (1 200 Wörter & Abb.)

941 621 .33 (09 (.43)
sers Annalen, Heft 9, 1. Mai, S. 147.
OUTERS (A.). — Ein Gedenktag der **elektrischen**
nen. (3 000 Wörter & Abb.)

941 697
sers Annalen, Heft 9, 1. Mai, S. 150.
CHMELZER. — **Klimaanlagen.** (5 000 Wörter
bb.)

1941 621 .335
Glasers Annalen, Heft 10, 15. Mai, S. 159.
RIEDIG (F.). — **Achslastausgleichvorrichtungen** für elektrische Abraumlokomotiven. (3 000 Wörter & Abb.)

1941 656 .136 (.43)
Glasers Annalen, Heft 10, 15. Mai, S. 162.
NESCHKES (R.). — **Elektrische Oberleitungs=Omnibusse** in Deutschland. (1 200 Wörter & Abb.)

1941 625 .616
Glasers Annalen, Heft 11, 1. Juni, S. 178.
SCHROETER (H.). — **Einheitslokomotiven** für deutsche Kolonialbahnen in Afrika. (3 000 Wörter, 1 Zahlentafel & Abb.)

Gleistechnik und Fahrbahnbau. (Karlsruhe.)

1942 625 .113
Gleistechnik und Fahrbahnbau, Heft Nr. 19/20, 15. Oktober, S. 73; Heft Nr. 21/22, 15. November, S. 81.
PIHERA (H.). — Der **Gleisbogen.** (4 000 Wörter Tafeln & Abb.)

1942 625 .14
Gleistechnik und Fahrbahnbau, Heft Nr. 21/22, 15. November, S. 84.
FINDEIS (R.). — Gedanken über den **Rohstoffverbrauch beim Gleisbau.** (1 800 Wörter & Abb.)

1942/1943 625 .151
Gleistechnik und Fahrbahnbau, Heft Nr. 23/24, 15. Dezember, S. 89; Heft Nr. 1/2, 15. Januar, S. 1; Heft Nr. 3/4, 15. Februar, S. 9.
HANKER (R.). — Die **Ablenkvorrichtung der Weichen.** (4 700 Wörter, Tafeln & Abb.)

1943 625 .151 (.43) & 625 .614 (.43)
Gleistechnik und Fahrbahnbau, Heft Nr. 3/4, 15. Februar, S. 12.
HEUVEL (Ph. van den). — Die **Federzungenweiche** im Strassenbahn-Oberbau. (800 Wörter & Abb.)

1943 625 .112 (.73) & 625 .176 (.73)
Gleistechnik und Fahrbahnbau, Heft Nr. 3/4, 15. Februar, S. 14.
Die **Spurweite** der Eisenbahnen in den Vereinigten Staaten. (1 200 Wörter.)

1943 625 .1 (0, 625 .2 (0 & 625 .41
Gleistechnik und Fahrbahnbau, Heft Nr. 5/6, 15. März, S. 17.
WIESINGER (Kurt). — Das Schnellbahnproblem (Entwurf einer entgleisungssicheren **Ultraschnellbahn** — Hoch- und Halbhochbahn, für **rollenden Zwanglauf**). (3 500 Wörter, eine Karte & Abb.)

1943 385. (091 (.494) & 625 .13 (.494)
Gleistechnik und Fahrbahnbau, Heft Nr. 7/12, 15. Mai, S. 25.
WERNEKKE. — Von den **Schweizer Eisenbahnen,** ihren Gleisen und Kunstbauten. (5 000 Wörter.)

Die Lokomotive. (Bielefeld-Berlin.)

1941 **621** .134 .2 (.43)
Die Lokomotive, Nr. 5, Mai, S. 65.
BOTH (O.) & SCHULZ (K.). — Die **Heissdampf-Kolbenschieber** mit schmalen federnden Ringen der chemaligen Preussischen Eisenbahn-Verwaltung und der Deutschen Reichsbahn. (3 200 Wörter & Abb.)

1941 **621** .131 & **621** .133 .2
Die Lokomotive, Nr. 6, Juni, S. 79.
WIDDECKE (M.). — Möglichkeiten weiterer **Steigerung der Kesselleistung** besonders von Lokomotiven mit sehr grossen Rosten. (9 000 Wörter & Abb.)

1941 **656** .222 .1 (.43)
Die Lokomotive, Nr. 6, Juni, S. 92.
HÜPEDEN (M.). — Zahlen zur Geschichte des deutschen **Schnellzugverkehrs.** (1 000 Wörter, 5 Zahlentafeln & Abb.)

1941 **621** .131 .1
Die Lokomotive, Nr. 7, Juli, S. 99.
NEESEN. — Die **Hochleistungs-Lokomotive.** (6 000 Wörter & Abb.)

1941 **385.** (09 (.87)
Die Lokomotive, Nr. 7, Juli, S. 112.
Die **Eisenbahnen** « Venezuelas ». (800 Wörter & Abb.)

1941 **621** .431 .72 (.498)
Die Lokomotive, Nr. 8, August, S. 117.
LÖWENTRAUT (H.). — 4400 PS **dieselelektrische Schnellzug-Lokomotive** für die Rumänische Staatsbahn. (3 300 Wörter & Abb.)

1941 **621** .132 .6 (.43)
Die Lokomotive, Nr. 8, August, S. 124.
PFEIFER (H.). — 1'C1' — **Heissdampf-Tender-Lokomotive** für gemischten Dienst. (1 200 Wörter & Abb.)

Organ für die Fortschritte des Eisenbahnwesens. (Berlin.)

1941 **385.** (09 (.55) & **625** .1 (.55)
Organ für die Fortschritte des Eisenbahnwesens, Heft 2/3, 1. Februar, S. 16.
v. RABCEWICZ. — Einiges vom Bau der **Transiranischen Eisenbahn.** (6 000 Wörter & Abb.)

1941 **621** .431 .72 (.43) & **625** .234 (.43)
Organ für die Fortschritte des Eisenbahnwesens, Heft 2/3, 1. Februar, S. 28.
MÖLBERT (F.) & SCHMITT (H.). — Neue **Warmwasserheizung** in den Triebwagen der Deutschen Reichsbahn unter besonderer Berücksichtigung der **Leichtmetallbauweise.** (3 800 Wörter & Abb.)

1941 **621** .13
Organ für die Fortschritte des Eisenbahnwesens, Heft 2/3, 1. Februar, S. 33.
Baustoffe einer Lokomotive für hohe Geschwindigkeiten. (2 000 Wörter & Tafel.)

1941 **656** .212
Organ für die Fortschritte des Eisenbahnwesens, Heft
15. Februar, S. 39.
WITTE (Fr.). — **Rangiergerät** mit seitlich au
schwenkbarer Zug- und Stossvorrichtung. (5 000 Wört
& Abb.)

1941 **656**
Organ für die Fortschritte des Eisenbahnwesens, Heft
15. Februar, S. 47.
DORMANN. — Der Platzbedarf für das **Aufstell**
von Kraftfahrzeugen. (3 000 Wörter, 5 Zusammenst
lungen & Abb.)

1941 **621** .431 .72 & **625** .2
Organ für die Fortschritte des Eisenbahnwesens, Heft
1. März, S. 57.
RÖBLING. — **Versuchsdrehgestell** für Schnelltrie
wagen. (3 900 Wörter & Abb.)

1941 **625** .253 (.4 + .7
Organ für die Fortschritte des Eisenbahnwesens, Heft
1. März, S. 63.
HILDEBRAND (F.). — Die **Entwicklung der Güt**
zugbremse in den Vereinigten Staaten und in Euro
unter dem Einfluss der Betriebsverhältnisse. (5 800 W
ter & Abb.)

1941 **621** .392 & **625**
Organ für die Fortschritte des Eisenbahnwesens, Heft
15. März, S. 75.
REITER (M.). — Die Arbeitsverfahren beim **B**
geschweisster Schienenfahrzeuge. (5 600 Wörter & Ab

1941 **656** .211
Organ für die Fortschritte des Eisenbahnwesens, Heft
15. März, S. 84.
ZOCHE (Th.). — **Rangieranlagen für die Reisez**
bildung. (7 000 Wörter, 2 Tafeln & Abb.)

Die Reichsbahn. (Berlin.)

1942 **656** .254 (.
Die Reichsbahn, Heft 5/6, 4./11. Februar, S. 44.
BECKER (K.). — Der Arbeitsplatz des **Fahrdie**
leiters. (1 300 Wörter & Abb.)

1942 **385.** (09 (.4
Die Reichsbahn, Heft 7/8, 18/25. Februar, S. 65.
Dr. OVERMANN. — 25 Jahre « **Niederländis**
Eisenbahnen » (3 500 Wörter & Abb.)

1942 **385.** (09 (.
Die Reichsbahn, Heft 9/10, 4./11. März, S. 76; H
13/15, 1./8./15. April, S. 114.
HAUSTEIN. — Das **Werden der Grossdeutsc**
Reichsbahn im Rahmen des Grossdeutschen Reich
(24 000 Wörter.)

1942 **625** .14 & **656** .22
Die Reichsbahn, Heft 16/17, 22./29. April, S. 133.
MEYER (K.). — **Mehrgleisiger Streckenausbau.** (7
Wörter & Abb.)

1942 **656** .222 .5 (.47) & **656** .234 (.
Die Reichsbahn, Heft 18/19, 6./13. Mai, S. 152.
TIMMA (E.). — **Reiseverkehr** in der Sowjetun
(6 000 Wörter & 3 Karten.)

1942 **385 .113 (.43)**
ie Reichsbahn, Heft 24/25, 17./24. Juni, S. 200.
Geschätsbericht der Deutschen Reichsbahn über das
schäftsjahr 1941. (5 000 Wörter.)

1942 **385 .517 .6 (.43)**
ie Reichsbahn, Heft 26/28, 1./8./15. Juli, S. 221.
GÜNTHER (H.). — Die **Kranken- und Sterbegeld-**
schusskasse der Deutschen Reichbahn von 1904 bis
42. (2 000 Wörter.)

1942 **385 .517 (.438)**
e Reichsbahn, Heft 29/30, 22./29. Juli, S. 234.
GUISCHARD (B.). — **Personalfürsorge** bei der Ost-
hn. (6 000 Wörter & Abb.)

1942 **656 .222 .6**
ie Reichsbahn, Heft 31/32, 5./12. August, S. 251.
EGGERT. — Beitrag zur Bekämpfung von **Stockungen**
Güterzugbetrieb. (1 000 Wörter.)

itschrift des Vereines deutscher Ingenieure. (Berlin.)

1941 **669 & 691**
itschrift des Vereines deutscher Ingenieure, Nr. 3,
18. Januar, S. 73.
MAYR (F.). — **Werkstoffeinsparung** bei Stütz- und
agbauteilen im Maschinenbau. **Konstruktive Mass-**
hmen und **Werkstoffaustausch.** (1 500 Wörter & Abb.)

1941 **621 .392**
itschrift des Vereines deutscher Ingenieure, Nr. 3,
18. Januar, S. 76.
n CONRARDY (H.). — Der Werkstoffübergang im
hweisslichtbogen. (900 Wörter & Abb.)

1941 **669 & 691**
itschrift des Vereines deutscher Ingenieure, Nr. 5,
1. Februar, S. 127.
BECKER (G.), DAEVES (K.) & STEINBERG (F.).
Korrosionsschutz durch Chrom-Diffusionszonen. (1 700
örter, 1 Zahlentafel & Abb.)

1941 **536**
itschrift des Vereines deutscher Ingenieure, Nr. 7,
15. Februar, S. 163.
SCHMIDT (E.). — Fortschritte der **wärmetechnischen**
rschung. (5 600 Wörter.)

1941 **625 .144 .1 & 625 .144 .2**
itschrift des Vereines deutscher Ingenieure, Nr. 7,
15. Februar, S. 173.
KAMMERER (A.). — Untersuchung von **Gleisver-**
rfungen. (800 Wörter & Abb.)

1941 **621 .116**
itschrift des Vereines deutscher Ingenieure, Nr. 8,
22. Februar, S. 177.
SCHULZ (E.). — **Dampfkesselschäden** durch Werk-
ffüberhitzung. (6 500 Wörter, 2 Zahlentafeln & Abb.)

1941 **62. (01 & 621 .82**
itschrift des Vereines deutscher Ingenieure, Nr. 9,
1. März, S. 201.
KÜHNEL (R.). — Bewährung der **metallischen Gleit-**
ger-Werkstoffe im Spiegel des neueren Schriftums.
000 Wörter & Tabellen.)

1941 **621 .335 (.45)**
Zeitschrift des Vereines deutscher Ingenieure, Nr. 9, 1. März, S. 212.
Elektrischer Triebzug der italienischen Staatsbahnen. (300 Wörter & Abb.)

1941 **624 .1**
Zeitschrift des Vereines deutscher Ingenieure, Nr. 9, 1. März, S. 215.
SCHÖNHÖFER (R.). — Neuartige Ausführungen von **Brückenauflagern.** (1 100 Wörter & Abb.)

Zeitschrift für das gesamte Eisenbahn-Sicherungs- und Fernmeldewesen. (Berlin.)

Signal und Draht. (Berlin.)

1943 **656 .256 .3**
Zeitschr. für das ges. Eisenb.-Sicherungs- und Fernmeldew., Nr. 6/7, 20. Mai, S. 33.
GRADL (J.). — Induktionsschutz für **Strecken-Blockleitungen.** (2 500 Wörter & Abb.)

1943 **654 (.43) & 656 .25 (.43)**
Signal und Draht, Nr. 9, 20. Juli, S. 51.
Zusammenstellung der 1942 bei der DRB im **Sicherungs- und Fernmeldewesen** eingeführten Neuerungen und durchgeführte Versuche. (4 500 Wörter.)

1943 **654**
Signal und Draht, Nr. 10/11, 20. August, S. 59; Nr. 12, 10. September, S. 71; Nr. 14/15, 20. November, S. 83; Nr. 16, 10. Dezember, S. 91.
WETZER (R.). — **Ortsfeste Morseeinrichtungen.** (10 000 Wörter & Abb.)

1943 **656 .256 (.47)**
Signal und Draht, Nr. 10/11, 20. August, S. 62; Nr. 12, 10. September, S. 67.
CHAUSSETTE. — Das russische **Blocksystem.** (4 000 Wörter & Abb.)

1943 **656 .254 (.43)**
Signal und Draht, Nr. 13, 10. Oktober, S. 75.
BIEDENDORF (K.). — **Läuteeinrichtungen** und **Zugvormelder.** (4 000 Wörter & Abb.)

1943 **656 .257 (.43)**
Signal und Draht, Nr. 14/15, 20. November, S. 86.
GLÄSEL. — **Stellwerksschilder.** (2 200 Wörter & Abb.)

1944 **654 (.43)**
Signal und Draht, Nr. 1, 10. Januar, S. 1.
FAULHABER (H.). — Die erste **Fernschreibstelle mit Hochkantförderbandanlage** bei der Deutschen Reichsbahn. (3 000 Wörter & Abb.)

1944 **385. (07 (.43)**
Signal und Draht, Nr. 2/3, 20. Februar, S. 10.
BREKLE. — Die **Reichsbahn-Nachrichtenschule** « S. » (2 000 Wörter & Abb.)

In English.

Bulletin, American Railway Engineering Association. (Chicago.)

1945 **62.** (01 (.73) & **625** .151 (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 453, June-July, p. 1.
Preliminary report of Committee 5. Track. **Stress measurements** on various designs of solid manganese **crossing frogs.** (2 500 words & fig.)

1945 **625** .143 .5 (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 453, June-July, p. 39.
Preliminary report of Committee 5. Track. Effect of the form of tie plate rail seat on **stresses in rail base flanges** and lower web fillets. (2 500 words, tables & fig.)

1945 **625** .14 (01 (.73) & **625** .2 (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 453, June-July, p. 48.
ALLEMAN (N. J.). — The effect of the **ratio of wheel diameter to wheel load** on extent of rail damage. (4 000 words, tables & fig.)

1945 **625** .151 (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 454, September-October, p. 1.
Determination of lateral ontward forces on each rail of a **turnout.** (5 000 words & fig.)

1945 **624** (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 454, September-October, p. 27.
WYLY (L. T.). — Two problems in **bridge design.** (4 000 words & fig.)

1945 **62.** (01 (.73) & **621** .392 (.73)
Bulletin, Amer. Railway Engineering Assoc., No. 454, September-October, p. 55.
Progress report on fatigue strength of **structural welds.** (500 words & fig.)

Engineer. (London.)

1946 **621** .132 .3 (.42)
Engineer, No. 4715, May 24, p. 466; No. 4716, May 31, p. 490.
NOCK (O. S.). — British **locomotive working in wartime.** (400 words & fig.)

1946 **621** .87
Engineer, No. 4715, May 24, p. 471.
A **mobile excavator crane.** (1 500 words & fig.)

1946 **621** .132 .3 (.42)
Engineer, No. 4716, May 31, p. 505.
L. N. E. R. **Pacific locomotive** No. 500. (700 words & fig.)

1946 **621** .132. 4 (. 73)
Engineer, No. 4718, June 14, p. 537.
American **geared locomotives.** (1 100 words & fig.)

1946 **627** .82 (.44
Engineer, No. 4719, June 21, p. 557; No. 4720, June 28 p. 579.
L'Aigle **Dam,** France. (5 800 words & fig.)

Journal, Institute of Transport. (London.)

1945 **656** .212 .9 (.42) & **725** .32 (.42
Journal, Institute of Transport, November-Decembe p. 174.
ROYLE (T. W.). — **Modern methods of handlin goods at railway stations.** (4 200 words & fig.)

Journal, Institution of Civil Engineers. (London.

1942 **621** .135 (0
Journal, Institution of Civil Engineers, No. 3, January p. 197; No. 8, October, p. 464.
COLAM (Sir H. N.) and WATSON (Major J. D.). — **Hammer-blow in locomotives:** can it not be abolishe altogether? (30 000 words, tables & fig.)

1942 **621** .135 (
Journal, Institution of Civil Engineers, No. 3, January p. 221; No. 8, October, p. 464.
COX (E. S.). — **Balancing of locomotive reciprocatin parts.** (126 000 words, tables & fig.)

1942 **691** & **721**
Journal, Institution of Civil Engineers, No. 4, Februar p. 315; No. 8, October, p. 501.
EVANS (R. H.). — Relative merits of wire and b reinforcement in pre-stressed **concrete beams.** (7 5 words, tables & fig.)

1942 **625** .14 (01 (.4
Journal, Institution of Civil Engineers, No. 6, Apr p. 115.
WALLACE (W. K.). — **Permanent way tests a practice** on the London Midland and Scottish Railwa (23 000 words, tables & fig.)

1942 **721**
Journal, Institution of Civil Engineers, No. 7, Jun p. 293; No. 8, October, p. 558.
SMITH (E. C.). — **Soil mechanics:** The factor safety of clay banks. (5 200 words, tables & fig.)

1942 **721**
Journal, Institution of Civil Engineers, No. 7, Ju p. 307.
SKEMPTON (A. W.). — An investigation of t bearing capacity of **soft clay soil.** (6 800 words, tab & fig.)

Journal, Institution of Engineers, Australia. (Sydney, N. S. W.)

1942 **6**
Journal, Institution of Engineers, Australia, No. June, p. 137.
ANDREWS (K. E.). — **Proportioning of concre** with special reference to the grading of aggregat (800 words & tables.)

942 **624 .2**
rnal, Institution of Engineers, Australia, No. 7,
July, p. 157.
INDLER (J. E.). — Compression, flanges of larger
e **girders.** (3 600 words, table & fig.)

942 **691**
rnal, Institution of Engineers, Australia, No. 7,
July, p. 161.
ILSON (R.). — The history of **ready mixed con-**
e. (4 500 words.)

942 **624 .51 (.73)**
nal, Institution of Engineers, Australia, No. 7, July,
p. 170.
ENNIS (S.). — The Tacoma **suspension bridge.**
00 words, tables & fig.)

942 **625 .111 (.943) & 625 .162 (.943)**
rnal, Institution of Engineers, Australia, No. 8,
August, p. 177.
ANKS MOTT (Ch.). — Bowen Bridge **road level**
sing elimination works. (10 000 words & fig.)

942 **691 & 721 .9**
nal, Institution of Engineers, Australia, No. 9,
September, p. 201.
OBIN (R. C.), OLSEN (P. E.) & KINNANE (R.
— Bond strength of **reinforcing bars** embedded
zontally in concrete. (10 000 words, tables & fig.)

942 **669 & 691**
nal, Institution of Engineers, Australia, No. 11,
November, p. 253.
IGHTINGALL (V. C. J.). — The **corrosion of iron**
steel and problems of prevention. (6 000 words
g.)

942 **621 .97 & 691**
nal, Institution of Engineers, Australia, No. 11,
November, p. 259.
ELBY-HELE (R. H.). — Some features of the pre-
tion, workmanship, and inspection of **riveted con-**
ions. (4 000 words & fig.)

rnal, Permanent Way Institution. (London).

941 **625 .22**
nal, Permanent Way Institution, April, p. 59.
AMNETT (R. A.). — **Structure clearances.** (4 000
ls & fig.)

941 **625 .112 (.73)**
nal, Permanent Way Institution, April, p. 71.
E (Ch. E.). — **Standard gauge** in the U. S. A.
0 words.)

41 **625 .1 (.5)**
nal, Permanent Way Institution, August, p. 109.
NDERLINK (E. R.). — Problems in **railway**
truction in the Far East. (6 000 words.)

41 **625 .142 .2**
nal, Permanent Way Institution, August, p. 142.
CK (J.). — War-time method of **timbering.**
0 words & fig.)

41 **665 .882**
nal. Permanent Way Institution, August, p. 148.
RE (R. E.). — **Oxygen cutting.** (6 000 words
.)

1941 **625 .142 .4 (.42)**
Journal, Permanent Way Institution, December, p. 202.
Concrete sleepers on the Great Western Railway. Some notes on experience during the past 25 years, with special reference to modern practice. (600 words & fig.)

1941 **625 .17**
Journal, Permanent Way Institution, December, p. 208.
CHAPLIN (C. J.). — The duties and responsibilities of an **assistant engineer.** (3 500 words.)

1941 **625 .143 .5**
Journal, Permanent Way Institution, December, p. 217.
Anchoring track to meet present-day conditions. (4 000 words.)

The Locomotive. (London.)

1945 **621 .132 .3 (.42)**
The Locomotive, No. 637, September 15, p. 128.
New G. W. R **.4-6-0 « 1000 » class engine.** (300 words & fig.)

1945 **621 .132 .3 (.42)**
The Locomotive, No. 637, September 15, p. 134.
Modified class K 3 2-6-0 L. N. E. R. locomotive. (250 words & fig.)

1945 **621 .132 .1 (.44)**
The Locomotive, No. 637, September 15, p. 137; No. 639, November 15, p. 169.
CLARKE (J. T.). — Some recollections of old French **locomotives.** (1 300 words & fig.)

1945 **621 .132 .3 (.42)**
The Locomotive, No. 639, November 15, p. 160.
Rebuilt « Pacific » No. 4470 « Great Northern » L. N. E. R. (400 words & fig.)

1945 **621 .132 .5 (.73)**
The Locomotive, No. 639, November 15, p. 163.
POULTNEY (E. C.). — New York Central **4-8-4 type locomotive.** (1 800 words & fig.)

1945 **621 .134 .4 (.42)**
The Locomotive, No. 639, November 15, p. 166.
DOHERTY (J. M.). — **Compounding** and present-day British locomotive practice. (1 400 words & fig.)

1945 **625 .232 (.42)**
The Locomotive, No. 639, November 15, p. 168.
Restaurant cars for the G. W. R. (500 words.)

1945 **621 .133 .1 (.42)**
The Locomotive, No. 640, December 15, p. 178.
G. W. R. **oil-burning locomotives.** (1 100 words & fig.)

1945 **621 .13 (09**
The Locomotive, No. 640, December 15, p. 180.
HAMILTON ELLIS (C.). — Famous **locomotive engineers.** (3 600 words & fig.)

1945 **621 .132 .3 (.944)**
The Locomotive, No. 640, December 15, p. 187.
HICKEY (T. M.). — **« The Inter-City Express »** New South Wales. (2 200 words & fig.)

Mechanical Engineering. (New York.)

1946 **621 .132 (.73), 625 .24 (.73) & 625 .25 (.73)**
Mechanical Engineering, No. 2, February, p. 107.
Progress in **railway mechanical engineering** 1944-1945. (6 000 words & fig.)

1946 **621 .13 (.73)**
Mechanical Engineering, No. 5, May, p. 419.
BUER (J. V. B.). — **Locomotive trends** on the Pennsylvania Railroad. (5 000 words & fig.)

1946 **621 .133 .1**
Mechanical Engineering, No. 6, June, p. 547.
BROWNE (K. A.). — **Future use of coal** in railway motive power. (4 000 words.)

Modern Transport. (London.)

1945 **621 .132 .5 (.73)**
Modern Transport, October 27, p. 3.
POULTNEY (E. C.). — **New freight locomotives** in U. S. A. (1 800 words & fig.)

1945 **625 .111**
Modern Transport, October 27, p. 9.
WELLS (H. A.). — **Elimination of level crossings.** Some practical suggestion. (1 600 words & fig.)

1945 **656 .224 (.42)**
Modern Transport, October 27, p. 13.
The travelling post office. (2 000 words & fig.)

1945/1946 **625 .23 (09 (.42)**
Modern Transport, November 3, p. 7; December 1, p. 5; January 5, p. 19; February 9, p. 15; March 9, p. 16; April 6, p .19; April 27, p. 5; May 18, p. 15.
British railway carriages (to be continued). (18 200 words & fig.)

1945 **656 .212 .7 (.42)**
Modern Transport, November 3, p. 15.
VINE (W. H.). — **The L. M. S. clerical system.** Goods Department methods. (3 000 words & fig.)

1945 **656 .212 .7 (.42)**
Modern Transport, November 10, p. 3.
Road and rail traffic exchange. Improved goods shed layout. (3 800 words & fig.)

1945 **621 .133 .1 (.42)**
Modern Transport, November 10, p. 15.
Oil fuel on the G. W. R. locomotives and shed installations. (1 400 words & fig.)

Proceedings, Institution of Mechanical Engineers. (London.)

1945 **621 .116**
Proceedings, Institution of Mechanical Engineers, vol. 153 (War emergency issue No. 9), p. 261.
SILVER (R. S.). — A thermodynamic theory of circulation in **water-tube boilers.** (26 000 words.)

1945 **621 .131**
Proceedings, Institution of Mechanical Engineers, v
153 (War emergency issue No. 10), p. 351.
JOHANSEN (F. C.). — **Locomotive practice** (Eff
of surface finish on performance). (1 400 words.)

1945 **621 .133**
Proceedings, Institution of Mechanical Engineers, v
153 (War emergency issue No. 9), p. 282.
WALTER (A. J. R.). — Modern methods of **wa**
treatment. (7 000 words & fig.)

Railway Age. (New York.)

1946 **625 .26 (.73) & 725 .33 (.7**
Railway Age, March 23, p. 612.
Modern shop puts skill and efficiency in **work equ**
ment repairs. (3 500 words & fig.)

1946 **621 .132 .5 (.7**
Railway Age, March 23, p. 629.
Reading **4-8-4, class T/locomotives.** (1 400 wo
& fig.)

1946 **656 .254 (.7**
Railway Age, March 30, p. 666.
Automatic O S reporting of trains by electronics
the Rock Island. (1 000 words & fig.)

1946 **669**
Railway Age, March 30, p. 678.
SMITH (R.), WYCHE (E. H.) & GORR (W. W.).
Introducing **stainless W — a new product.** (3 100 wor

1946 **656 .222 .5 (.**
Railway Age, March 30, p. 681.
Can **passenger traffic** be held? (1 200 words.)

1946 **656 .28 (06 (.**
Railway Age, March 30, p. 693.
Finds three roads at fault in **accident.** (1 500 wor

1946 **625 .144 .4 (.**
Railway Age, April 20, p. 811.
What machines did for small rail gang. (2 200 w
& fig.)

1946 **621 .133 .3 (**
Railway Age, April 20, p. 816.
HALL (John M.). — **Fusion-welded locomotive**
lers. (1 800 words & fig.)

1946 **656 .285 (**
Railway Age, April 20, p. 835.
Accident attributed to **defective brakes.** (1 100 wo

1946 **385. (08 (**
Railway Age, April 20, p .842.
Canadian Pacific Railway Company. Sixty-fifth **an**
report of the Directors. (9 000 words.)

1946 **621 .132 .3 (.73) & 621 .132 .5 (**
Railway Age, April 27, p. 860.
North Western **class H locomotives** are being m
nized. (1 800 words & fig.)

1946 **656 .25**
Railway Age, April 27, p. 863.
Big **signal program** on Canadian Pacific. (3 600 w
& fig.)

Railway Engineering and Maintenance. (Chicago.)

1940 614 .8

ilway Engineering and Maintenance, July, p. 447.
Preventing accidents in a machine age. (2 400 words
fig.)

1940 624 .1 (.73)

ilway Engineering and Maintenance, July, p. 450.
Displaced bridge pier jacked back into position.
200 words & fig.)

1940 625 .143 (.73)

ilway Engineering and Maintenance, Sept,. p. 559.
Rail. The foundation of railway progress. (18 000
rds & fig.)

1940 624

ilway Engineering and Maintenance, Sept., p. 574.
Places **long girder span** with one locomotive crane.
100 words & fig.)

1940 625 .142

ilway Engineering and Maintenance, Nov., p. 729.
CLARKE (H. R.). — Renewing 50 000 000 **ties** a
ar. (3 900 words & fig.)

1940 725 .31

ilway Engineering and Maintenance, Dec., p. 822.
KUHLER (O.). — **Must streamline passenger stations**
), says noted designer. (2 100 words & fig.)

1941 625 .143 .4

ilway Engineering and Maintenance, January, p. 26.
CHANEY (A. B.). — Making **rail joints** last longer.
000 words & fig.)

1941 625 .144 .4

ilway Engineering and Maintenance, May, p. 330.
Two-rail-gang organization eliminates all back travel.
100 words & fig.)

1941 625 .144 .4

ilway Engineering and Maintenance, May, p. 334.
Mechanized tie gangs produce quality work with large
vings. (3 000 words & fig.)

1941 656 .28 (01 (.73)

ilway Engineering and Maintenance, May, p. 345.
Method used to cut rail may have caused accident.
000 words.)

1941 625 (.73)

ilway Engineering and Maintenance, June, p. 396.
A quarter century in railroading brings many changes
maintenance and construction. (28 000 words & fig.)

1941 625 .143 (.73) & 625 .144 .4 (.73)

ilway Engineering and Maintenance, June, p. 534.
Pennsylvania crops **rails** in track. (2 300 words & fig.)

Railway Gazette. (London.)

1946 625 .1 (.42)

ilway Gazette, No. 7, February 15, p. 171.
Carlisle to Kingmoor **widening**, L. M. S. R. (2 100
rds & fig.)

1946 656 .251 (.71)

Railway Gazette, No. 8, February 22, p. 195.
Signalling at the new Montreal station C. N. R.
(2 200 words & fig.)

1946 656 (.54)

Railway Gazette, No. 8, February 22, p. 198.
Converting road lorries to run on B. B. & C. I. R.
(800 words & fig.)

1946 656 .28

Railway Gazette, No. 8, February 22, p. 203.
Staff and labour. — Fatal accident while oiling and cleaning apparatus. (800 words & fig.)

1946 621 .335 (.42)

Railway Gazette, No. 9, March 1, p. 219; No. 13, March 28, p. 353; No. 17, April 26, p. 458; No. 25, June 21, p. 682.
Service tests of electric locomotives. (4 500 words & fig.)

1946 656 .256 (.44)

Railway Gazette, No. 9, March 1, p. 221.
Standardizing the block working in France. (1 800 words & fig.)

1946 725 .35 (.42)

Railway Gazette, No. 9, March 1, p. 223.
L. M. S. R. new road vehicle **repair workshop** at Bradford. (1 300 words & fig.)

Railway Magazine. (London.)

1946 621 .132 .1 (.42)

Railway Magazine, July-August, p. 209.
ALLEN (C. J.). — British **locomotive practice and performance.** (2 400 words.)

Railway Mechanical Engineer. (New York.)

1940 625 .24 (0 (.73)

Railway Mechanical Engineer, June, p. 223.
WILLOUGHBY (V. R.). — Problems of **freight-car weight reduction.** (2 500 words & fig.)

1940 625 .222 .1 (.73)

Railway Mechanical Engineer, June, p. 226.
How to increase freight-train speeds. (1 500 words.)

1940 621 .132 .5 (.73)

Railway Mechanical Engineer, September, p. 337.
Alco builds twenty **D & H locomotives.** (4 000 words & fig.)

1940 625 .215 (.73)

Railway Mechanical Engineer, September, p. 345.
A. A. R. high-speed freight car truck test report. (5 600 words & fig.)

1940 625 .248 (.73)

Railway Mechanical Engineer, September, p. 364.
JOHNSON (L. B.). — **Unit mechanically cleans tank-car interiors.** (1 400 words & fig.)

1941 621 .132 .3 (.73)

Railway Mechanical Engineer, June, p. 218.
Modernization of Erie **4-6-2 locomotives.** (1 500 words & fig.)

1941 **621 .331 (.45)**
Rivista tecnica delle ferrovie italiane, 15 febbraio, p. 53.
DONATI (F.). — Una moderna **sottóstazione** a corriente continua 3 000 V. per la trazione ferroviaria. (18 000 parole, tavole & fig.)

1941 **621 .431 .72 (.45) & 625 .26 (.45)**
Rivista tecnica delle ferrovie italiane, 15 marzo, p. 113.
CUTTICA (A.) & RICCHENA (S.). — **Officina motori** delle F. S. (3 000 parole & fig.)

1941 **62. (01**
Rivista tecnica delle ferrovie italiane, 15 marzo, p. 121.
PERFETTI (A.). — Cause organiche di errori nelle **macchine per prove materiali** ai vari gradienti di carico. (4 500 parole & fig.)

1941 **621 .335 (.45)**
Rivista tecnica delle ferrovie italiane, 15 aprile, p. 149.
D'ARBELA (A.). — Le **locomotive elettriche** a corrente continua 3 000 Volt, Gr. E. 636. (9 000 parole, tavole & fig.)

1941 **625 .172**
Rivista tecnica delle ferrovie italiane, 15 aprile, p. 187.
CORIO (L.). — **Diserbamento chimico** delle linee ferroviarie. (600 parole & fig.)

1941 **621 .133 .7**
Rivista tecnica delle ferrovie italiane, 15 aprile, p. 190.
NALINI (G.). — Un nuovo grado idrotimetrico nella determinazione della **durezza delle acque.** (2 000 parole & 1 tabella.)

In Dutch.

Spoor- en Tramwegen. (Utrecht.)

1941 **656 .222 .4 (.492)**
Spoor- en Tramwegen, Nr 4, 15 Februari, p. 65; Nr 5, 1 Maart, p. 89.
VAN WIJK (H. P. D.). — Het **bedrijfsregistreertoestel** der N. S. (3 800 woorden & fig.)

1941 **385 .113 (.43 + .492 + .493)**
Spoor- en Tramwegen, Nr 4, 15 Februari, p. 69.
De **inkomsten** van de spoorwegen. (2 500 woorden.)

1941 **385. (09 (.55 + .56)**
Spoor- en Tramwegen, Nr 5, 1 Maart, p. 83; Nr 6, 15 Maart, p. 108.
VAN SETTEN (D.). — De **Staatsspoorwegen** van Irak en Iran. (5 700 woorden & fig.)

1941 **625 .113**
Spoor- en Tramwegen, Nr 6, 15 Maart, p. 105.
JACOPS (A.). — Fout in het berekenen van **overgangsbogen.** (3 200 woorden & fig.)

1941 **656 .211 (.492)**
Spoor- en Tramwegen, Nr 7, 29 Maart, p. 123.
VAN SETTEN (D.). — Het **Centraal Station** te Amsterdam en het Ij. (4 400 woorden & fig.)

1941 **625 .3 (.**
Spoor- en Tramwegen, Nr 9, 26 April, p. 169.
De Duitsche **bergbanen.** (1 080 woorden & 1 tabel.)

1941 **625 .**
Spoor- en Tramwegen, Nr 10, 10 Mei, p. 183.
VAN HULZEN (J.). — Het **geremd gewicht.** (2 7
woorden & fig.)

1941 **529 .**
Spoor- en Tramwegen, Nr 10, 10 Mei, p. 191.
HENNING (R.). — Het **uurprobleem.** (1 600 woor
& 2 tabellen.)

1941 **656 (.4**
Spoor- en Tramwegen, Nr 11, 24 Mei, p. 205.
Het Nederlandsche **verkeer.** (3 200 woorden.)

1941 **624 .63 (.4**
Spoor- en Tramwegen, Nr 11, 24 Mei, p. 215.
Bruggenbouw der Bondsspoorwegen in Bern. (1
woorden & fig.)

1941 **656 .**
Spoor- en Tramwegen, Nr 12, 7 Juni, p. 225.
MONSMA (F. G.). — De lichtseinen bij **automatis**
waarschuwingsinstallaties voor onafgesloten overweg
(2 300 woorden & fig.)

1941 **621 .132 .8 (.43) & 625 .231 (.**
Spoor- en Tramwegen, Nr 13, 21 Juni, p. 241.
OVERMANN (J.). — De **gestroomlijnde trein**
twee verdiepingen tusschen Hamburg en Lübeck. (1
woorden & fig.)

1941 **656 (.4**
Spoor- en Tramwegen, Nr 14, 5 Juli, p. 261.
Spoor en auto in Zwitserland. (3 000 woorden.)

1941 **625 .2 &**
Spoor- en Tramwegen, Nr 15, 19 Juli, p. 281.
Lichte rijtuigconstructie. (2 600 woorden & 1 tab

1941 **625 .13 (.**
Spoor- en Tramwegen, Nr 16, 2 Augustus, p. 301.
WOLTERBEEK (C.). — De **spoorwegtunnel** te
sen. (3 500 woorden & fig.)

1941 **656 (.4**
Spoor- en Tramwegen, Nr 17, 16 Augustus, p. 330.
VAN DER MERSCH (H. M.). — Het probleem
verkeerscoordinatie in Nederland. (3 000 woorden.)

1941 **625 .232 (**
Spoor- en Tramwegen, Nr 17, 16 Augustus, p. 333.
De nieuwe **slaapwagens** van de Mitropa. (1 000 w
den & fig.)

1941 **621 .335 (**
Spoor- en Tramwegen, Nr 18, 30 Augustus, p. 341.
Electrische sneltreinlocomotief E 19 van de Deut
Reichsbahn. (1 000 woorden & fig.)

1941 **385 .(09 (**
Spoor- en Tramwegen, Nr 18, 30 Augustus, p. 343.
De ontwikkeling der **Turksche Staatsspoorwe**
(1 500 woorden & kaart.)

M. Weissenbruch Co., Ltd., Printer of the King, 49, rue du Poinçon, Bruxelles.